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NEW NUCLEAR DATA
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INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

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Nuclear Science Abstracts is issued twice a month throughout the calendar year by the Atomic Energy Commission. It is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only the unclassified and declassified research reports of the Atomic Energy Commission and its contractors, but also material in its field of interest which appears in technical and scientific journals and unpublished research reports of government agencies, universities, and industrial research establishments.

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Each issue of Vol. 8(1954) contains an author index to abstracts in that issue and a regularly cumulated supplement to the Numerical Index of Reports. Subject and author indexes, covering three-, six-, and nine-month periods, are issued as supplements to the sixth, twelfth, and eighteenth issues. The 24th issue will be the annual index for the volume.

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NEW NUCLEAR DATA

A summary of New Nuclear Data on Half-Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses.

The new nuclear data presented here have been prepared by the Nuclear Data Group which has been reorganized under the sponsorship of the National Research Council with the support and cooperation of the National Bureau of Standards.

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In this issue Nuclear Science Abstracts presents its second annual cumulation of new nuclear data. The material collected here is that which has appeared in the literature from about October 1952 to October 1953. The earlier parts have already been published in the quarterly cumulations, 6B(March 31), 12B(June 30), and 18B(September 30). A complete list of journals covered will be found on the following page.

The quarterly lists will be continued in 1954 with the new feature that each list will contain all previous 1954 data as well as the current quarter's material. It will then not be necessary to search through previous quarterly collections in order to find all the 1954 results for a given nucleus.

The data which are collected in the NSA lists are put on 3″ × 5″ cards as the papers are abstracted. A limited number of sets of these cards could be supplied promptly, possibly monthly, to laboratories or individuals on a cost basis, if the demand warrants. Those interested in subscribing for these cards, should write to the Nuclear Data Group, National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C.

ABBREVIATIONS

a	absorption measurement
$a\beta\gamma$	absorption of β's in coincidence with γ's
ace^-	absorption of conversion electrons
a coin	measurement by placing absorbers between counters in coincidence
α	total γ-ray conversion coefficient, N_e/N_γ
$\alpha_K, \alpha_L, \ldots$	γ-ray conversion coefficient for electrons ejected from the K,L,... shell
$\alpha_0, \alpha_1, \ldots$	α to g.s., first excited state, ... of residual nucleus
b	coefficient in angular correlation function, $1 + b\cos^2\theta$
B	band spectra method
$Be\gamma n$	measurement by detection of photoneutrons from Be
$\beta\gamma(\theta)$	angular correlation of β's and γ's in coincidence
Calc	calculated value from experimental work reported elsewhere
cc	cloud chamber
ce^-	conversion electrons
chem	chemical separation of product following reaction

Cpt	Compton electrons
d	(1) deuteron, (2) descendant of, (3) days, when used as superscript
d,p(θ)	angular distribution of protons with respect to deuteron beam
Dγn,Dγp	measurement by detection of photoneutrons or photoprotons from deuterium
$\bar{E}$	average energy
E_0	resonance energy
E_β,E_γ, . . .	energy of β ray, energy of γ ray, . . .
E_{dis}	disintegration energy
EA	electrostatic analyzer
E1,E2, . . .	electric dipole, electric quadrupole , . . .
ϵ	electron capture
ϵ_K,ϵ_L	electron capture from K, L shell
f	fission, in abbreviations for methods of production or detection
F-K	Fermi-Kurie β energy distribution plot
$\gamma(\theta$,T)	numbers of γ's as function of angle and temperature
$\gamma\gamma$,$\beta\gamma$, $\alpha\gamma$,nγ	$\gamma\gamma$,$\beta\gamma$, $\alpha\gamma$, or nγ coincidences. (0.123 γ) (0.246 γ, 0.325γ) means 0.123 γ in coincidence with 0.246 γ and 0.325 γ
Γ	resonance half-width (the whole width at half-maximum)
G-M	Geiger-Müller counter
g.s.	ground state
I	(1) nuclear induction magnetic resonance method; (2) spin in units h/2π. + or − signs after spin values denote even or odd parity of state in question
ic	ionization chamber
IT	isomeric transition
J	quantum state of compound nucleus in a nuclear reaction. "I" is used to denote the spin of the target nucleus, final nucleus
K/L	α_K/α_L
l	angular momentum of particle absorbed into nucleus
M	molecular or atomic beam resonance method

M1,M2, . . .	magnetic dipole, magnetic quadrupole . . .
mb	millibarns
Mic	microwave method
mir	measurement by total reflection of neutron beam from mirror surface
ms	mass spectrometer
μ	(1) magnetic moment in units of nuclear magnetons, (2) micron, 10^{-4} cm
μs	microseconds
osc	pile oscillator method
p	(1) proton, (2) predecessor of
para	paramagnetic resonance method
parentheses	parentheses are put around values which are given for identification purposes
pc	proportional counter
pe^-	photoelectrons
ppl	photoplates or emulsions
primes	primes indicate inelastically scattered particles
q	electric quadrupole moment in units of barns
quad res	quadrupole resonance method
Q	reaction energy in Mev
s	(1) spectrometer method, (2) seconds, when used as superscript
S	atomic spectra measurement
scin	scintillation counter
2 cryst scin s	2-crystal scintillation spectrometer
sl	lens spectrometer
sl;ce^-	conversion electrons measured in lens spectrometer
st	strong
sπ	180° spectrometer
s$\pi\sqrt{2}$	double focusing spectrometer
σ	cross section in barns
σ_0	cross section at resonance energy, E_0
σ_a	absorption cross section
σ_{el}	elastic scattering cross section
σ_{in}	inelastic scattering cross cross section
σ_s	scattering cross section
σ_t	total cross section
t	triton, H^3
T	(1) isotopic spin; (2) temperature
τ	half life in units indicated
τ_1,τ_2	half life of upper, lower state

$\tau_{\beta\beta}$, $\tau_{\epsilon\epsilon}$ — half life for double β, double ϵ decay
th — thermal
w,vw — weak, very weak
% — % of disintegrations
† — relative numbers. When used in connection with γ rays, relative numbers of photons, not photons plus conversion electrons, are meant
+, − — even, odd parity when used in connection with level properties

Standard journal abbreviations are used.

All energies are given in Mev and all cross sections in barns unless otherwise stated in the tabular material.

MAGNETIC MOMENT STANDARDS

In order to have a consistent basis for recording data on magnetic moments, results have been based on the following values and are without diamagnetic corrections.

$\mu(H^1) = 2.7934$ nuclear magnetons

This value has been adopted arbitrarily because it is the one used as a base in the Table of H. L. Poss, The Properties of Atomic Nuclei, I. Spins, Magnetic Moments. (Revised, BNL-26 (T-10), (unclassified).) The values reported in the New Nuclear Data summaries are thus directly comparable with those listed in the survey of Poss.

$\nu(Na^{23})/\nu(H^1) = 0.26450$ E. Bleuler, M. Gabriel, Helv. Phys. Acta 20, 67(1947).

$\nu(D)/\nu(H^1) = 0.153506$ F. Bloch, E. C. Levinthal, M. E. Pachard, Phys. Rev. 72, 1125 (1947).

$\nu(B^{11})/\nu(H^1) = 0.320827$ D. A. Anderson, Phys. Rev. 76, 434(1949).

LIST OF JOURNALS SURVEYED FOR NSA 7

Acta Phys. Acad. Sci. Hung. 1(1952); 2(1953); 3, No. 1(1953).
Acta Phys. Austriaca 6, Nos. 2-4(1952); 7, 1-3 (1953).
Acta Phys. Polon. 11(1951-1953); 12, Nos. 1-2 (1953).
Anales real soc. españ. fis. y quim. 48, Nos. 9-12(1952); 49, 1-8(1953).
Ann. Phys. 7, May-Dec. (1952); 8, Jan.-June (1953).
Ann. Physik 11(1952); 12, (1953).
Arkiv Fysik 4, Nos. 5-6; 5(1952); 6, 1-4(1953).
Australian J. Phys. 6, Nos. 1-2(1953).
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Bull. Research Council Israel 1, Nos. 1-4 (1951); 2, 1-3(1953).
Can J. Chem. 30, Nos. 11-12(1952); 31, 1-9 (1953).
Can. J. Phys. 30, Nos. 5-6(1952); 31, 1-6(1953).
Compt. rend. 235, Nos. 15-25(1952); 236; 237, 1-13(1953).
Czechoslov. J. Phys. 1, Nos. 1-2(1952).
Doklady Akad. Nauk SSSR 83, Nos. 4-6; 84-86(1952); 87-89; 90, Nos. 1-5(1953).
Experientia 8, Nos. 11-12(1952); 9, 1-9(1953).
Helv. Phys. Acta 25, Nos. 5-7(1952); 26, 1-5 (1953).
Indian J. Phys. 26, Nos. 7-12(1952); 27, 1-3 (1953).
Izvest. Acad. Nauk. Ser. Fiz. SSSR 15, (1951); 16, (1952).
J. Am. Chem. Soc. 74, Nos. 20-24(1952); 75, 1-18(1953).
J. Chem. Phys. 20, Nos. 11-12(1952); 21, 1-9 (1953).
J. de Chim. Phys. 49, Nos. 11-12(1952); 50, 1-8(1953).
J. Franklin Inst. 254, Nos. 5-6(1952); 255; 256, 1-3(1953).
J. Phys. Chem. 55(1951); 56(1952); 57, Nos. 1-6(1953).
J. Phys. radium 13, Nos. 5-12(1952); 14, 1-9 (1953).

J. Phys. Soc., Japan 7, No. 6(1952); 8, 1-4 (1953).
J. Research Nat. Bur. Standards 49, Nos. 5-6 (1952); 50; 51, 1-2(1953).
Koninkl. Ned. Akad. Wetenschap. Ser. B 46-55 (1946-1952); 56, Nos. 1-3(1953).
Kgl. Danske Videnskab. Selskab, Mat-fys. Medd. 27, Nos. 7-16(1952); 28, 1 (1953).
Nature 170, Nos. 4326-4339(1952); 171; 172, 4366-4378(1953).
Naturwiss. 39, Nos. 16-24(1952); 40, 1-17(1953).
Nuovo Cim. 9, Nos. 11-12(1952); 10, 1-9(1953).
Phil. Mag. 43, Nos. 343-347(1952); 44, 348-356 (1953).
Physica 18, Nos. 8-12(1952); 19, 1-8(1953).
Phys. Rev. 88(1952); 89-91(1953).
Proc. Phys. Soc., (London) 65A, Nos. 392-396 (1952); 66A, 397-405(1953); 66B, 397-405 (1953).
Proc. Roy. Soc., (London) 215A(1952); 216A-219A(1953).
Rev. fac. sci. univ. Istanbul 10-17(1945-1952); 18, Nos. 1-3(1953).
Rev. Mexicana Fis. 1(1952); 2, Nos. 1-3(1953).
Sitzber. Akad. Wiss. Wien, Math-naturv. Kl. IIa 159(1950); 160(1951); 161, Nos. 1-6(1953).
Trans. Chalmers Univ. Technol. Gothenburg Nos. 1-130(1941-1953).
Zhur. Eksptl'i Teoret. Fiz. 22, Nos. 2-6; 23, 1-5(1952).
Z. Naturf. 7a, Nos. 9-12(1952); 8a, 1-8(1953).
Z. Phys. 132, Nos. 4-5; 133(1952); 134; 135, 1-4(1953).

NEW NUCLEAR DATA

H^2 1 1

μ 0.857608 I

$\mu(D)$ / (H^1)=0.307012192±0.000000015 H^1H^2

T.F.Wimett, Phys. Rev. 91,499A(1953).

Capture γ $H^1(n,\gamma)$ E_n= th scin

2.23

No lower energy γ's observed

A.Bracci, U.Facchini, A.Malvicini, Phys. Rev. 90, 162(1953); Nuovo Cim. 10,949(1953).

H^3 1 2

β^- 0.0180 log ft = 3.006 s

Neutrino mass <0.250 kev

F-K plot straight down to 5.5 kev

L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 689(1952).

He^3 2 1

I 1/2 M

G.Weinrich, V.W.Hughes, Phys. Rev. 90,377A(1953).

He^4 2 2

$H^3(p,n)He^3$ E_p = 1 to 5

Broad max. at ~3 long counter

p,n(θ) indicates l_p=1 predominant

H.B.Willard, J.K.Bair, J.D.Kington, Phys. Rev. 90,865(1953).

Capture γ $H^3(p,\gamma)$ E_p= 0.80

20.3 scin

J.B.Warren, G.M.Griffiths, Phys. Rev. 92, 1084A (1953).

$H^3(p,\gamma)$ E_p=1 to 5.2

No resonance for production of ~20-Mev γ's

Yield curve flattens at E_p~3.5 scin

H.B.Willard, J.K.Bair, J.D.Kington, Phys. Rev. 90, 865,(1953).

$H^3(p,\gamma)$ E_p= 1 to 4.3

No resonance for production of ~20-Mev γ's

γ yield curve still rising at E_p = 4.3

J.E.Perry, Jr., S.J.Bame, Jr., Phys. Rev. 90,380A (1953).

$H^3(p,\gamma)$ E_p= 3 to 7.3

No resonance for production of ~20-Mev γ's

γ yield curve still rising at E_p= 7.3

R.W.Birge, J.Jungerman, UCRL-2109(1953).

He^4 2 2

$H^3(d,n)$ E_d= 0.20 ppl

No level between 1 and 13 Mev ($\sigma/\sigma_{g.s}$<0.015)

L.Rosen, Nucleonics 11, No. 8,38(1953).

$He^3(d,p)$ E_d = 10.2 ppl

No level below 20.9 Mev ($d\sigma/d\Omega$ for excited state <0.2 mb/sterad. at 90° lab.)

J.C.Allred, Phys. Rev. 84, 695(1951).

$He^4(p,p')$ E_p = 32 pc

No level below 23.3 Mev ($d\sigma/d\Omega$ for low energy p group <0.1 mb/sterad. at 45° c.m.)

J.Benveniste, B.Cork, Phys. Rev. 89, 422(1953).

He^5 2 3

Levels $H^3(He^3,p)$ E_{He^3} = 0.30 scin

g.s. group observed at E_p = 9.05

No other p group found

W.M.Good, W.E.Kunz, C.D.Moak, ORNL-1415(1952).

Levels $He^4(n,n)He^4$ E_n = 4.14 lc

n,$He^4(\theta)$ g.s. $p_{3/2}$

1.76 $p_{1/2}$

P.Huber, E.Baldinger, Helv. Phys. Acta 25, 435 (1952).

Levels $Li^7(d,\alpha)$ E_d = 0.98 ppl

g.s. Γ = 0.3

2.5 Γ = 1.5

P.Cüer, J.J.Jung, Compt. rend. 236,1252(1953).

Level $H^3(d,n)He^4$ E_n=0.01 to 1.73 pc

16.65 J=3/2 +

σ_{max} = 5.1 ± 0.1 for E_d = 0.109

J.P.Conner, T.W.Bonner, J.R.Smith, Phys. Rev. 88, 468(1952).

Level $H^3(d,n)He^4$ E_d = 0.015 to 0.125

16.64

σ_{max} = 4.95 for E_d = 0.107

E.J. Stovall, Jr., W.R.Arnold, J.A.Phillips, G.A. Sawyer, J.L.Tuck, Phys. Rev. 88, 159A(1952).

Level $H^2(t,n)He^4$ E_t = 0.08 to 1.2

t,n(θ) 16.65 J = 3/2 + long counter

σ_{max} = 4.9 ± 0.5 for E_t = 0.165

H.V.Argo, R.F.Taschek, H.M.Agnew, A.Hemmendinger, W.T.Leland, Phys. Rev. 87, 612(1952).

He^6 2 4

τ 0.83^s pc

$Li^6(n,p)$ $Li^7(n,d)$ $Be(n,\alpha)$

M.E.Battat, F.L.Ribe, Phys. Rev. 88, 159A (1952); 88, 156(1952).

$He^6_{2\ 4}$ τ 0.84^s $Be^9(n,\alpha)$

G.Vendryes, Ann. Phys. 7, 655(1952).

$(\beta)(Li^6)(\theta)$, Li^6 time of flight spectra, suggest β-neutrino angular correlation of tensor interaction

J.S.Allen, W.K.Jentschke, Phys. Rev. 89,902A (1953).

$(\beta)(Li^6)(\theta)$ indicates tensor predominates over axial vector interaction $N\alpha\gamma(<3\%)$

B.M.Rustad, S.L.Ruby, Phys. Rev. 89,880(1953).

$Li^5_{3\ 2}$ Level $He^3(d,p)He^4$ E_d=0.26 to 3.6
16.80 J = 3/2 + scin
σ_{max}= 0.90 for E_d= 0.43

J.L.Yarnell, R.H.Lovberg, W.R.Stratton, Phys. Rev. 90,292(1953).

Level $He^3(d,p)He^4$ E_d=0.19 to 1.60 pc
16.78 J = 3/2 +
σ_{max} = 0.69 for E_d = 0.400

T.W.Bonner, J.P.Conner, A.B.Lillie, Phys. Rev 88, 473(1952).

$Li^6_{3\ 3}$ Level $Be^9(p,\alpha\gamma)$ E_p= 2.565 s pe^-
γ 3.57 M1 e^+spectrum

R.J.Mackin, Jr., Phys. Rev. 92, 1084A(1953).

No 3.58 level by $Li^6(d,d')$ E_d = 7.70 sπ
3.58 level was observed by $Li^6(p,p')$

C.P.Browne, C.K.Bockelman, W.W.Buechner, A.Sperduto, Phys. Rev. 90,340A(1953).

No reaction $Li^6(\gamma,d)He^4$
σ < ~6 x 10^{-6} for E_γ = 2.76, ~7, 17.6
Isotopic spin forbidden*

*A.Bamba, V.Wataghin, Nuovo Cim. 10, 174(1953).
E.W.Titterton, T.A.Brinkley, Proc. Phys. Soc. 65A, 1052(1952).

No reaction $Li^6(\gamma,d)$ He^4 pc
σ<3.5 x 10^{-3} for E_γ= 2.62 enriched Li^6

P.Jensen, K.Gis, Z.Naturf. 8a, 137(1953).

$Li^7_{3\ 4}$ Level $Li^6(d,p)$ $Be^9(d,\alpha)$ s
0.477

E.R.Collins, C.D.McKenzie, C.A.Ramm, Proc. Roy. Soc. 216A, 242(1953).

Level $Li^6(d,p)$ E_d= 1.5
γ 0.4774 ± 0.020 sl pe^-
Values with Doppler correction

R.G.Thomas, T.Lauritsen, Phys. Rev. 88,969(1952).

Level $Be^9(d,\alpha\gamma)$ E_d= 0.40 scin
$\alpha\gamma(\theta)$ (0.478) I = 1/2

R.G.Uebergang, N.W.Tanner, Australian J. Sci. Res. 6A, 53(1953).

$Li^7_{3\ 4}$ Levels $B^{10}(n,\alpha)$ E_n = th pc
5.8† g.s.
94.2† (0.478)
† Relative cross sections

U.H.Hauser, Z. Naturf. 7a, 781(1952).

Level $Li^6(d,p\gamma)$ E_d = 0.41
$p\gamma(\theta)$ (0.478) I = 1/2

A.J.Salmon, E.K.Inall, Proc. Phys. Soc. 66A, 297(1953).

Levels $Be^9(d,\alpha)$ s

	E_d = 0.47	E_d = 1.0
g.s.	100†	100†
(0.478)	100†	70†
4.62	20†	100†

H^3 continuum observed from 4.62 level
†Relative yields at 90°

R.W.Gelinas, S.S.Hanna, Phys. Rev. 89, 483(1953).

Level $Li^6(n,t)He^4$ E_n = 0.27 ppl
n,t(θ) (7.4) J = 5/2

W.O.Solano, J.H.Roberts, Phys. Rev. 89, 892A (1953).

Levels $Li^7(\gamma,t)He^4$ E_γ = 6.13 ppl
$\gamma,\alpha(\theta)$ suggests 3/2 +, 1/2 − interference
σ = 2.7 x 10^{-5}

H.Nabholz, P.Stoll, H.Wäffler, Helv. Phys. Acta 25, 701(1952).

Resonances $Li^7(\gamma,t)He^4$ E_γ ≤ 16 ppl
~5.25 σ=~0.02 mb
7.25 σ= 0.13 mb
~9.25 σ=~0.02 mb

P.Stoll, M. Wächter, Nuovo Cim. 10,347(1953).

Resonances $Li^7(\gamma,t)He^4$ E_γ ≤ 24 ppl
9.3 21.5 ?
16.7 ? 23.5 ?
No structure resolved for $Li^7(\gamma,p)He^6$

E.W.Titterton, T.A.Brinkley, Proc. Phys. Soc. 66A, 194(1953).

$Li^7(\gamma,n)$ n yield
Yield curve analyzed into straight line segments
Breaks at E_γ= 9.6, 10.8, 12.4, 14, 17.5

K.Goldemberg, L.Katz, Phys. Rev. 92, 852A(1953).

$Li^6(n,t)He^4$ E_n=0.2 to 0.6
n,t(θ) shows l_n= 0 and 1 predominant ppl

L.E.Darlington, J.Haugsnes, H.M.Mann, J.H.Roberts, Phys. Rev. 89,892A; 90,1049(1953).

$Li^8_{3\ 5}$ τ 0.87^s Li(0.6-Mev d)

P.Bretonneau, Compt. rend. 236, 913(1953).

τ 0.89^s Li(0.53-Mev d)
$(12.5\beta)(1.5\alpha)(\theta)$ not isotropic
No 4.9γ (<0.8% of Li^8 decays)

D.S.Bunbury, Phys. Rev. 90,1121(1953).

Li^8 3 5

$Li^7(d,p)$ scin

$(12.5\beta)(1.5\alpha)(\theta)$ not isotropic

C.M.Class, S.S.Hanna, Phys. Rev. 89,877(1953).

Li^9 3 6

β^- and 2 α's found in μ meson star

$E_{\beta_0} \sim 8$, E_α(total) = 4.4 indicate decay of Li^9 via 6.8 level of Be^9

W.F.Fry, Phys. Rev. 89, 325(1953).

Be^7 4 3

τ (metal) 53.61^d Li(8.5-Mev p)

Counted for 5 months differential ic

τ dependent on chemical state

J.J.Kraushaar, E.D.Wilson, K.T.Bainbridge, Phys. Rev. 90, 610 (1953).

Level $Li^6(d,n)$* $B^{10}(p,\alpha)$** sl pe$^-$

γ 0.4289* ± 0.0020 E_d = 1.5

0.4285** ± 0.0018 E_p = 1.4

Values with Doppler correction

R.G.Thomas, T.Lauritsen, Phys. Rev. 88,969(1952).

Level $B^{10}(p,\alpha)$ E_p = 3.333,1.460 EA

0.429 ± 0.003

D.S.Craig, D.J.Donahue, K.W.Jones, Phys. Rev. 88, 808(1952).

Level Li(d,n) E_d = 0.93 ppl

1.81?

Can also be interpreted as 13.4 level in Be^8

J.Catalá, J.Agullos, F.Busquet, Anales, real, soc. espan. fis. y quim 49A, 131(1953).

Levels $Li^7(p,n)$ E_p = 18.3 ppl

4.6

7.1

D.M.Thomson, Phys. Rev. 88, 954(1952).

$Li^7(p,n)$ EA

Threshold 1.8816±0.0010

$Li^7(p,n)$thresh/$Mg^{24}(p,p\gamma)$thresh=1.3737±0.0005

K.W.Jones, M.T.McEllistrem, R.A.Douglas, H.T. Richards, Phys. Rev. 91, 482A (1953).

No reaction observed for $He(\alpha,n)$

σ < 7 x 10^{-4} for E_α = 39 (threshold = 38)

Consistent with odd parity for g.s.

D.Walker, W.T.Link, W.I.B.Smith, Proc. Phys. Soc. 65A, 861(1952).

Be^8 4 4

τ <5x10^{-14}s O^{16}(≲27-Mev γ)

From analysis of 38 4α-stars

C.H. Millar, A.G.W.Cameron, Can.J.Phys. 31, 723 (1953).

Level $Be^9(d,t)$ ppl

g.s.

$d,t(\theta)$ for E_d = 0.295,0.40,0.45,0.52,0.62

D.deJong, P.M.Endt, L.J.G.Simons, Physica 18, 676(1952).

Be^8 4 4

Levels $Be^9(d,t)$ E_d = 1.0 s

3.5+ g.s.

15+ (2.9)

+Relative yields at 90°

R.W.Gelinas, S.S.Hanna, Phys. Rev. 89, 483(1953).

Levels $B^{10}(d,\alpha)$ E_d = 0.59,0.78,1.07* ic

g.s

2.9 I = 2*

*From fit of theoretical curve to α energy spectrum

Only two α peaks at $E_\alpha \sim 12, \sim 9$

P.B.Treacy, Phil. Mag. 44, 325(1953).

Levels $Li^6(He^3,p)$ E_{He^3} = 0.72 scin

g.s.

3.2

Only two peaks at E_p = 14.6, 12.0

W.M.Good, W.E.Kunz, C.D.Moak, ORNL-1415(1952).

Level $Li^6(He^3,p)$ E_{He^3} = 0.72

2.9 $\Gamma \sim 1$ scin

No other level observed below 11 Mev

W.E.Kunz, C.D.Moak, W.D.Good, Phys. Rev. 91, 676 (1953).

Levels $Li^7(d,n)$ E_d = 0.68 ppl

2.2?* 4.1

2.9 5.0

*Seen for small angles only

$d,n(\theta)$ shows both stripping and compound nucleus formation

B.Trumpy, T.Grotdal, Å.Graue, Nature 170, 1118 (1952).

Levels $Li^7(d,n)$ E_d = 0.93 ppl

1.52	5.0	12.3
2.2	7.5	12.8
2.8	9.6	13.4*
3.5	10.6	14.1
4.0	12.1	

*Can also be interpreted as 1.81 level in Be^7

J.Catalá, J.Agullor, F.Busquets, Anales real soc. espan. fis. y quim. 49A, 131 (1953).

Levels $B^{11}(\gamma,t)$ E_γ = 17.6 ppl

2.9 Γ = 1.8

3.4 ± 0.2 Γ = 0.8

4.05?

O.Rochat, P.Stoll, Helv. Phys. Acta 25, 451(1952).

Levels $B^{10}(\gamma,d)$ $B^{11}(\gamma,t)$

2.2	4.0	E_γ≲31 ppl
2.9	4.9	
3.4	6.8	

All α emitting levels

P.Erdös, P.Scherrer, P. Stoll, Helv. Phys. Acta 26, 207 (1953).

Be^{8} 4 4

Levels $B^{11}(p,\alpha)$ $E_p = 0.163$ ppl, pc
2.2 4.0
2.9 4.9
3.4

H.Glättli, P.Stoll, Helv. Phys. Acta 26, 428 (1953).

Levels $B^{10}(d,\alpha)$ $E_d = 1.0$ s
2.87 $\Gamma = 0.9$
4.1?
~5.0
~7.5
9.6?
All α emitting levels $B^{10}(d,3\alpha) < 5\%$

P.Cüer, J.J.Jung, Compt. rend. 236, 2401 (1953).

Levels $C^{12}(\gamma,\alpha)$ $E_\gamma > 26$ ppl
$\gamma,\alpha(\theta)$ 2† g.s.
$\alpha\alpha(\theta)$ 10† (3-16)
12† 16.4?
56† 16.8 J=2+ $\Gamma<0.3$ T=1
20† 17.6 J=(2 or 4)+ $\Gamma<0.3$ T=1
$\gamma/\alpha<0.25$ for 16.8 and 17.6 levels
Initial α's from > 25-Mev levels in C^{12}

J.J.Wilkins, F.K.Goward, Proc. Phys. Soc. 66A, 661 (1953).

Levels
See C^{12}, D.L.Livesey, C.L.Smith, Proc. Phys. Soc. 66A, 689 (1953).

$Li^{7}(p,\gamma)$ EA
Resonance 0.4415 ± 0.0005 $\Gamma = 0.0122$
Level 17.628

S.E.Hunt, Proc. Phys. Soc. 65A, 982 (1952).

Level $Li^{7}(p,p)Li^{7}$ $E_p = 0.36$ to 1.4
$p,p(\theta)$ (17.63) J= 1+

W.D.Warters, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 91, 917 (1953).

Level $Li^{7}(p,\gamma)$ $E_p = 1.050$
γ (18.14) scin
Hard and soft γ's resonant at $E_p = 1.050$

A.A.Kraus, Phys. Rev. 92, 1085A (1953).

$p,\alpha(\theta)$ $Li^{7}(p,\alpha)He^{4}$ $E_p = 0.06$ to 0.90
$l_p = 1$ and 3

F.Hirst, Australian J. Sci. Res. 4A, 284(1951); 5A, 570(1952).

Be^{9} 4 5

Levels $Be(p,p')$ $E_p = 31.5$ scin
2.5 11.6
6.8

R.Britten, Phys. Rev. 88, 283(1952).

$B^{11}(d,\alpha n)Be^{8}$ $E_d = 0.425$ scin
n's observed, assigned to 2.4 level of Be^{9}

G.A.Dissanaike, J.O.Newton, Proc. Phys. Soc. 65A, 675(1952).

Be^{10} 4 6

Levels $Be^{9}(d,p)$ $E_d = 14.3$
$d,p(\theta)$ g.s. $l_n = 1$
(3.37) $l_n = 1$

C.F.Black, Phys. Rev. 90, 381A(1953).

Levels $Be^{9}(d,p)$ $E_d = 3.6$ ic
$d,p(\theta)$ g.s. $l_n = 1$
(3.37) $l_n = 1$

H.W.Fulbright, J.A.Brunner, D.A.Bromley, L.M. Goldman. Phys. Rev. 88, 700(1952).

Level Be(d,p) ppl
g.s.
$d,p(\theta)$ for E_d=0.295,0.40,0.45,0.52,0.62

D.deJong, P.M.Endt, L.J.G.Simons, Physica 18,676, (1952);18, 407(1952).

Level Be(d,p) $E_d = 1.2$
γ (3.38) E1 or E2 e^+ spectrum

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

Levels Be(d,p) $E_d = 3.49$ ppl
No states between g.s. and 3.37 level

F.Ajzenberg, Phys. Rev. 88, 298(1952).

Capture γ's $Be^{9}(n,\gamma)$ pair s
25 † 3.41
75 † 6.81
No 6.3γ observed
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 49(1953).

B^{9} 5 4

Level $Be^{9}(p,n)$ $E_p = 6.59$ ppl
2.37

F.Ajzenberg, C.M.Braams, W.W.Buechner, Phys. Rev. 91,674; 91, 463A (1953).

B^{10} 5 5

μ 1.80114* I
1.80082**
*$\nu(B^{10})/\nu(D) = 0.700065 \pm 0.00007$
**$\nu(B^{10})/\nu(Rb^{85}) = 1.11282 \pm 0.00005$
$Na_2B_2O_4$, D_2O, RbCl

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

|q| 0.099 $B(CH_3)_3$ quad res

H.G.Dehmelt, Z.Phys. 134,642(1953);133,528(1952).

No 1.74 level by $B^{10}(d,d')$ $E_d = 6.9$ sπ
1.74 level was observed by $B^{10}(p,p')$

C.K.Bockelman, C.P.Browne, A.Sperduto, W.W.Buechner, Phys. Rev. 90,340A(1953).

$\gamma\gamma$ $Be^{9}(d,n)$ $E_d \leqslant 1$ scin
(1.02γ) (0.72γ) (1.43γ,2.87γ) (0.72γ)

S.M.Shafroth, S.S.Hanna, Phys. Rev. 91,483A(1953).

$^{10}_{5}B_{5}$

Levels $Be^9(d,n)$ E_d=0.60 ppl

130†	g.s.	200†	2.20
360†	0.73	60†	2.85
25†	1.75	170†	3.64

† rel σ at 90°

A.J.Dyer, J.R.Bird, Australian J. Phys. 6,45 (1953).

Levels $Be(d,n)$ E_d= 3.39 ppl

d,n(θ)

g.s. l_p= 1	5.58	
0.72 l_p= 1	5.93	
1.75 l_p= 1	6.12	
2.15 l_p= 1	6.38	l_p= 2
3.53 l_p= 1	6.58	
4.78	6.77	
double 5.14 l_p= 0		

Possible levels at 5.37,572

F.Ajzenberg, Phys. Rev. 88, 298(1953); 87, 205A (1952); 82, 43(1951).

Level $B^{10}(p,p')$ E_p = 2.191 EA

0.719 ±0.0016

Level value indicates $\tau(0.718\gamma) > 10^{-13\,s}$

No other levels for $E_p \leqslant 4.2$

D.S.Craig, D.J.Donahue, K.W.Jones, Phys. Rev. 88, 808(1952).

Level $B(n,n'\gamma)$ E_n = 2.5

γ 0.717 scin

R.B.Day, Phys. Rev. 89, 908A(1953).

Levels $Be^9(d,n)$ E_d= 0.86 ppl

d,n(θ) (3.58) l_p= 1

L.L.Green, J.P.Scanlon, J.C.Willmott, Phil. Mag. 44, 919 (1953).

Capture γ's $Li^6(\alpha,\gamma)$ $E_\alpha \leqslant$ 1.5 scin

4.75 level I = 1+

100† 4.02

5.162 level I = 2+ T = 1?

70†	2.99
25†	4.49
5†	5.25

Level at 5.11 not observed; suggest I = 2-

†Transitions relative to sum of all transitions from initial level

D.H.Wilkinson, G.A.Jones, Phys. Rev. 91, 1575 (1953); 90, 722 (1953).

Capture γ's $Be^9(p,\gamma)$ scin

7.48 level E_p= 0.998

26†	0.41	26†	1.4
228†	0.72		7.5
64†	1.02		

7.56 level E_p= 1.087

108†	0.71	17†	~2
<5†	1.4	98†	6.8

No 0.41γ (<0.8†) No 1.02γ (<5†) No 7.56γ

W.F.Hornyak, T.Coor, Phys. Rev. 91,463A (1953); verbal report.

$^{10}_{5}B_{5}$

$Be^9(p,\gamma)$ E_p= 2.565

γ 8.1 s

(8.1γ of B^{10})/(3.57γ of Li^6) = 0.001

R.J.Mackin, Jr., Phys. Rev. 92, 1084A(1953).

$^{11}_{5}B_{6}$

q +0.047 $B(CH_3)_3$ quad res

H.G.Dehmelt, Z.Phys. 134,642(1953); 133,528(1952).

Levels $Li^7(\alpha,\gamma)$

	I*		I*
2.14	1/2 ±	8.93	3/2 +
4.46	5/2 +	9.19	7/2 +
5.03	1/2 ±	9.28	5/2 −
6.81	3/2 +		

*From γ intensities, $\alpha,\gamma(\theta)$, and $\gamma\gamma(\theta)$

G.A.Jones, D.H.Wilkinson. Phys. Rev. 88, 423 (1952).

d,p(θ) $B(d,p)$ E_d = 0.29 ppl

Graphs for g.s., 2.14, 4.46, and 5.03 levels

P.M.Endt, C.H.Paris, H.M.Jongerius, F.P.G.Valekx, Physica 18, 423(1952).

Levels $C^{13}(d,\alpha\gamma)$ E_d = 1.8

γ's 4.50 pair s

4.96

R.P.Bent, T.W.Bonner, R.F.Sipple, Phys. Rev. 91, 472A(1953); verbal report.

Levels $B^{10}(d,p)$ E_d=4.25 to 8.52 sm

7.99	9.19	
8.57	9.28	
8.93	10.32	double?

M.M.Elkind, A.Sperduto, Phys. Rev. 91,463A (1953); verbal report.

Levels $Be^9(d,n)B^{10}$ E_d = 0.96 ppl

d,n(θ) ~16.7 J = 3/2+

~16.7 J = 5/2−

J.S.Pruitt, S.S.Hanna, C.D.Swartz, Phys. Rev. 91 463A (1953).

$Be^9(d,t)Be^8$ E_d = 1.3 ppl

d,t(θ) shows forward peaking suggesting pick-up

P.Cüer, J.J.Jung, Phys. Rev. 89, 1151(1953).

$Be^9(d,t)Be^8$ $Be^9(d,p)Be^{10}$

σ's equal for E_d <0.40 ppl

D.deJong, P.M.Endt, L.J.G.Simons, Physica 18, 676(1952).

$^{12}_{5}B_{7}$

τ 0.022^s B(0.6-Mev d)

P.Bretonneau, Compt. rend. 236, 913(1953).

Levels $B^{11}(d,p)$ E_d=4.25 to 8.52 sm

0.95	2.72
1.67	3.38
2.62	

M.M.Elkind, A. Sperduto, Phys. Rev. 91,463A(1953); verbal report.

$^{10}_{6}C_{4}$

β^+		2.1 ± 0.1	$B^{(18\text{-Mev p})}$ chem; a
γ	100†	0.72	$\tau < 2\times10^{-7}$ s $\beta\gamma$ scin
	1.7†	1.03	

No 1.43γ (<0.21†) No 2.15γ (<0.024†)
Conclude β^+ to 1.75 level is 0+ ⟶ 0+
†Photons per disintegration

R.Sherr, J.B.Gerhart, Phys. Rev. 91, 909 (1953).

$^{11}_{6}C_{5}$

τ 20.25^{m} C^{12}(30-Mev p) scin

W.M.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952).

τ 20.74^{m} C(21-Mev He^3)

D.N.Kundu, T.W.Donaven, M.L.Pool, J.K.Long, Phys. Rev. 89, 1200(1953); Physica 18, 1304(1952).

$^{12}_{6}C_{6}$

Levels B^{11}(d,n) E_d = 8.1 ppl
g.s. l_p = 1
(4.43) l_p = 1

W.M.Gibson, Phil. Mag. 44, 297(1953).

Level C^{12}(n,n′γ) E_n = 5.5
γ 4.45 scin

R.B.Day, Phys. Rev. 89, 908A(1953).

Level C^{12}(p,p′γ) E_p = 7.1 scin
p,$\gamma(\theta)$ (4.43) I = 2

H.E.Gove, N.S.Wall, Can J. Phys. 31, 189(1953).

Level N^{15}(p,$\alpha\gamma$) E_p= 0.429, s
p,$\gamma(\theta)$; p,$\alpha(\theta)$ 0.890, 1.210
(4.43) I = 2+

A.A.Kraus, Jr., A.P.French, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 89,299(1953).

Level N^{15}(p,$\alpha\gamma$) E_p= 1.6
4.443 ± 0.020 sl Cpt
Value with Doppler correction. Use of correction implies $\tau < 3\times10^{-13}$ s

R.G.Thomas, T.Lauritsen, Phys. Rev. 88,969(1952).

γ's Be^9(α,nγ)
3† 3.16
100† (4.43)
No 7.6γ (< 0.04†)

L.E.Beghian, H.H.Halban, T.Husain, L.G.Sanders, Phys. Rev. 90,1129(1953).

Levels N^{14}(d,α) E_d= 0.62 s
100† (4.43)
6† 7.68 ± 0.03
No other level below 9.2 Mev (<1†)

F.Hoyle, D.N.F.Dunbar, W.A.Wenzel, W.Whaling, Phys. Rev. 92, 1095A(1953).

Levels C(p,p′) E_p = 31.5 scin
4.3 9.5
7.5 ? 11 – 17 unresolved group

R.Britten, Phys. Rev. 88, 283(1952).

$^{12}_{6}C_{6}$

Level C^{12}(n,nα)Be^8g.s. $E_n \sim 25$ cc
9.7 Γ = 1.6

J.D.Jackson, D.I.Wanklyn, Phys. Rev. 90,381A(1953).

B^{11}(p,γ)C^{12} EA
Resonance 0.1638±0.0002 Γ = 0.0073
Level 16.099 absolute measurement

S.E.Hunt, W.M.Jones, Phys. Rev. 89,1283(1953).

Levels B^{11}(p,α)Be^8 E_p= 0.13 to 0.28
p,$\alpha(\theta)$ (16.10) J = 2+ pc
(16.57) – ?
p,$\alpha(\theta,E_p)$ shows interference between 16.10 and higher level

D.M.Thomson, A.V.Cohen, A.P.French, G.W.Hutchinson, Proc. Phys. Soc. 65A, 745(1952).

Levels B^{11}(p,γ) E_p= 0.15 to 0.5
(16.10) J = 2+
(16.57) –?
(17.22) –?
p,16$\gamma(\theta,E_p)$ has $\cos^2\theta$ term not f(E_p)
p,12$\gamma(\theta,E_p)$ has cos θ term f(E_p)
showing interference between 16.10 level and higher level a,G-M

H.Glättli, P.Stoll, Helv. Phys. Acta 25, 455(1952).

Levels B^{11}(p,γ) E_p= 0.2 to 1.1
(16.10) (J = 2+)
(16.57) –?
(17.22) –?
p,12$\gamma(\theta,E_p)$ has cos θ term f(E_p)
showing interference between 16.10 level and one or both higher levels scin

G.L.Jenkins, L.W.Cochran, B.D.Kern, T.M.Hahn, Phys. Rev. 91, 915; 91, 210A(1953).

Levels B^{11}(p,γ) E_p= 0.6 to 2.8
(16.57) J = 2–
(17.22) J = (2+)
17.8
18.3 J = 2+
p,$\gamma(\theta,E_p)$ for 12 and 16 γ's

H.E.Gove, E.B.Paul, Phys. Rev. 91, 463A(1953); verbal report.

Levels B^{11}(p,γ) scin

≤6/150†	16.10	J = 2+	(Γ = 0.005)
≤2/48 †	16.58	J = 2–	Γ = 0.33
35/18 †	17.22	J = 1–	Γ = 1.27

† $\sigma[(p,\gamma)C^{12}$g.s.$]/\sigma[(p,\gamma)C^{12}$ 4.4 level$]$ in μb

Level	γ's		
16.10	4.45	11.6 (M1)	~16 (E2)
16.58	4.44	12.0 (E1)	~16.4 (M2)
17.22	4.45	12.7 (E1)	~16.9 (E1)

T.Huus, R.B.Day, Phys. Rev. 91,599(1953).

$C^{12}_{6\ 6}$

Levels $B^{11}(p,\alpha)Be^8$ E_p= 0.4 to 2 s

≤0.2/600†	16.58	J = 2−	Γ = 0.3
6/150†	17.22	J = 1−	Γ ~1

† $\sigma[(p,\alpha)Be^8 g.s.]/\sigma[(p,\alpha)Be^8 \sim 3$ level] in mb

O.Beckman, T.Huus, Č.Zupančič, Phys. Rev. 91,606 (1953).

Levels $B^{11}(p,\alpha)Be^8$ E_p=0.4 to 2.8 s

Yield†	Level	J	Γ
35.4/0.04	16.57	2−	0.25
8.8/1.0	17.22	2+	1.20
2.3/1.4	17.8	0+ ?	0.15
110.5/2.6	18.3		0.30

†Relative yield (Be^8 3-Mev level)/(Be^8g.s.)α's

E.B.Paul, R.L.Clarke, Phys. Rev. 91,463A (1953).

Level $B^{11}(p,p'\gamma)B^{11}$ E_p= 2.5 to 3.0
18.391→p' + 2.13γ scin

T.Huus, R.B.Day, Phys. Rev. 91,599(1953).

Levels $C^{12}(\gamma,3\alpha)$ E_γ ≤70 ppl
18 others ? 310 stars
29

W.K.Dawson, C.B.Bigham, Can. J. Phys. 31, 167 (1953).

Levels $C^{12}(\gamma,3\alpha)$ E_α≤ 70 ppl

40†	12.7	110†	19.5
35†	13.8	35†	20.7
115†	15.0	130†	21.9
110†	15.9	30†	23.2
125†	16.8	230†	24.3
190†	17.3	130†	25.4
330†	18.3	270†	26.5
130†	18.9	st	29.4

F.K.Goward, J.J.Wilkins, Proc. Roy. Soc. 217A (1953); Proc. Phys. Soc. 65A,671(1952).

$O^{16}(\gamma,4\alpha)$ $C^{12}(\gamma,3\alpha)$ $C^{12}(n,n'3\alpha)$
Levels in O^{16},C^{12},Be^8 connected by α emission ppl

O^{16}	C^{12}	Be^8	
20-24	9.6	g.s.	
20-24	11.3	g.s.	
20-24	12	~3	
——	15-19	~3	
——	>25	~17	
25	——	~4.3	O^{16}→$2Be^8$?
28-30	16	~3?	

E_γ≤26 to 32

D.L.Livesey, C.L.Smith, Proc. Phys. Soc. 66A,689 (1953).

$C^{12}(\gamma,\alpha)Be^8$ E_γ= 17.6 ppl
σ(Be^8 g.s.)/σ(Be^8 ~3-Mev level) = 0.025 (cf O^{16})

H.Nabholz, P.Stoll, H.Wäffler, Helv. Phys. Acta 25, 701(1952).

$C^{12}(\gamma,\alpha)Be^8$ E_γ≤27 ppl
σ(Be^8g.s.)/σ(Be^8~3-Mev level) = ~ 0.09

C.H.Millar, A.G.Cameron, Can. J. Phys. 31,723 (1953).

$C^{12}_{6\ 6}$

$O^{16}(\gamma,4\alpha)$ E_γ≤ 48 ppl
Reaction proceeds 90% via 16-Mev C^{12} level for E_γ> 25

C.A.Hsiao, V.L.Telegdi, Phys. Rev. 90,494;91,473A (1953).

$C^{12}(\gamma,n)$ n yield
Yield curve analyzed into straight line segments
Breaks at E_γ= 19.3, 19.7, 20.1, 20.5, 20.7, 21.1, 21.6, 22.4, 22.8

L.Katz, J.Goldemberg, Phys. Rev. 92, 852A(1953).

$C^{13}_{6\ 7}$

Levels $C^{12}(d,p)$ E_d=7.86 ppl
d,p(θ) g.s. l_n=1 σ = 0.09
(3.09) l_n=0 σ = 0.12

J. Catalá, F.Senent, J. Casanova, Anales real soc. españ. fís. y quím.49A,91(1953).

Level C(d,p) E_d= 1.5
γ 3.082 ± 0.007 sl pe⁻
E1 e⁺ spectrum
Value with Doppler correction. Use of correction implies $\tau < 3x10^{-13}$s

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1953).

d,p(θ) graph C(d,p) E_d = 0.37 ppl

B.Koudijs, P.M.Endt, J.M.van der Hart, P.J.W. Palmer, Physica 18, 415(1952).

Level $C^{13}(p,p')$ E_p = 8 s
3.69

J.C.Arthur, A.J.Allen, R.S.Bender, H.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952).

Capture γ's $C^{12}(n,\gamma)$ pair s
30 † 3.68
70 † 4.95
No 3.9γ observed (< 6†)
† Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 49(1953).

Capture γ $C^{12}(n,\gamma)$ pair s
4.949 ± 0.006

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31,537 (1953).

$B^{10}(\alpha,p)$ E_p= 1.54
p group to 3.68, 3.89 but not 3.08 level
No 0.7 level (<0.5% of g.s.)

G.Manning, B.Singh, Proc. Phys. Soc. 66A, 842 (1953).

Levels $C^{12}(n,n)C^{12}$ E_n = 2.6 to 4.15
n,n(θ) 7.67 $d_{5/2}$
7.75 $s_{1/2}$
Rise in σ_t at E_n = 3.6 not resonance

P.Huber, E.Baldinger, R.Budde, Helv. Phys. Acta 25, 444(1952).

$_6C^{13}_7$

Level $C^{12}(n,n)C^{12}$ $E_n = 3.62$ scin
n,n(θ) (8.20) $d_{3/2}$

A.E.Remund, R.Ricamo, Helv. Phys. Acta 25, 447 (1952).

Levels $Be^9(\alpha,n\gamma)C^{12}$ $E_\alpha \leq 3.0$ scin

	E_0
11.98	1.90
w 12.50	2.65

F.L.Talbott, N.P.Heydenburg, Phys. Rev. 90,186 (1953).

C^{14} 6 8

F-K plot linear to 25 kev s

C.S.Wu, A.Schwarzschild, Phys. Rev. 91,483A(1953)

F-K plot concave toward energy axis below 50 kev although S^{35} and Pm^{147} plots linear to 10 kev

J.P.Mize, D.L.Zaffarano, Phys. Rev. 91,210A(1953).

$C^{13}(d,p)$ $E_d = 1.8$ pair s
No 4.1 pair emitting level found

R.D.Bent, T.W.Bonner, R.F.Sipple, Phys. Rev. 91, 472A (1953).

Level $C^{13}(d,p)$ $E_d = 1.4$
γ 6.110 ± 0.030 sl Cpt
Value without Doppler correction

R.G.Thomas, T.Lauritsen, Phys. Rev. 88,969(1953).

Level $C^{13}(d,p)$ $E_d = 4.06$ ppl
d,p(θ) (6.1) $l_n = 0$

R.E.Benenson, Phys. Rev. 90,420 (1953).

d,p(θ) graph $C^{13}(d,p)$ $E_d = 0.37$ ppl

B.Koudijs, P.M.Endt, J.M. van der Hart, P.J.W. Palmer, Physica 18, 415(1952).

N^{13} 7 6

τ 10.05^m C(0.456-Mev p)

J.L.W.Churchill, W.M.Jones, S.E.Hunt, Nature 172, 460(1953).

$C^{12}(p,\gamma)N^{13}$ EA
Resonance 0.4568 ±0.0005 Γ = 0.040
Level 2.367 absolute measurement

S.E.Hunt, W.M.Jones, Phys. Rev. 89, 1283 (1953).

N^{14} 7 7

μ 0.40370 I
$\nu(N^{14})/\nu(Rb^{85}) = 0.74837 \pm 0.00004$
HNO_3, RbCl

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

Levels $C^{13}(d,n)$ $E_d = 3.89$ ppl
d,n(θ)

	l_p
2.2	1
3.85	1
4.80	0

N^{14} 7 7

	l_p
4.97	1?
5.5	0?
5.76	
6.1	
6.23	
6.43	
7.00	1?
7.50	0?
8.08	

R.E.Benenson, Phys. Rev. 90,420 (1953).

No 2.31 level by N(d,d) $E_d = 6.98$ sπ
2.31 level was observed by N(p,p)

C.K.Bockelmann, C.P.Browne, A.Sperduto, W.W.Buechner, Phys. Rev. 90,340A(1953).

Levels $N^{14}(\alpha,\alpha')$ $E_\alpha = 21.2$ a

4.10	7.03
5.22	7.95
5.72	8.64
6.01	9.23

2.31 level not observed (isotopic spin forbidden)

B.M.Carmichael, M.B.Sampson, O.E.Johnson, Phys. Rev. 91,473A(1953; verbal report.

Levels $C^{13}(p,p)C^{13}$ $E_p = 0.45$ to 1.60
p,p(θ)

(8.06)	J = 1-
(8.62)	J = 0+
(8.70)	J = 0-
8.90	J = 2- or 3-
8.98	J = 1+, 2+, or 3+

E.A.Milne, Phys. Rev. 92,1085A(1953).

Levels $C^{13}(p,n)N^{13}$ $E_p = 3.2$ to 5.0 pc

	E_0	Γ
11.05	3.78	0.10
11.26	4.01	0.02
11.35	4.10	0.15
11.44	4.18	0.03
11.74	4.52	0.12
12.0	4.8	0.10

J.K.Bair, J.D.Kington, H.B.Willard, Phys. Rev. 90,575(1953).

Levels $B^{10}(\alpha,p)C^{13}$ $E_p = 0.5$ to 1.5 pc
12.29
12.39
12.47

G.Manning, B.Singh, Proc. Phys. Soc. 66A,842(1953).

Levels $B^{10}(\alpha,p\gamma)C^{13}$ $E_\alpha \leq 3.0$ scin

	E_0
12.68	1.50
12.77	1.63
12.81	1.68
12.92	1.83
13.17	2.16
~13.23	~2.27
~13.72	~2.95

F.L.Talbott, N.P.Heydenburg, Phys. Rev. 90,186 (1953).

N^{14}
7 7

Capture γ's $C^{13}(p,\gamma)$ $E_p = 0.554$ scin

~25†	2.35	~18†	4.45
~10†	2.75	~4†	5.1
~15†	3.05	100†	(8.06)

D.Hicks, T.Husain, L.G.Sanders, L.E.Beghian, Phys. Rev. 90,163(1953).

$C^{13}(d,n\gamma)$ $E_d = 1.4,\ 1.6$

γ's

0.725* ± 0.004	3.381 ± 0.0013
1.638 ± 0.008	5.052 ± 0.0025
2.310 ± 0.012	5.690 ± 0.0050

Values without Doppler correction sl pe⁻,Cpt
*Assignment uncertain

R.G.Thomas, T.Lauritsen, Phys. Rev. 88,969(1953).

γ's $C^{13}(d,n\gamma)$ $E_d = 1.8$ pair s

3.36	5.72
5.13	6.14?

R.D.Bent, T.W.Bonner, R.F.Sipple, Phys. Rev. 91, 472A (1953); verbal report.

N^{15}
7 8

Levels $N^{14}(d,p)$ $E_p = 5$ to 8 s

7.58	9.16	10.53
8.31	10.06	10.69
8.57	10.45	10.80
9.05		

A.Sperduto, W.W.Buechner, M.M.Elkind, W.J.Fader Phys. Rev. 473A (1953); verbal report.

Levels $C^{14}(p,n)$

p,n(θ)

(11.294)	J = 1/2(-?)
(11.429)	J = 1/2+
(12.096)	J = 5/2-
(12.147)	J = 3/2-
(12.327)	J = 5/2±

R.Kay, H.Mark, C.Goodman, Phys. Rev. 91,472A (1953); verbal report.

Levels $N^{14}(n,n)N^{14}$ pc

n,n(θ)

(12.327)	$l_n = 1$
(12.494)	$l_n = 2$

J.L.Fowler, C.H.Johnson, J.R.Risser, Phys. Rev. 91,441A(1943); verbal report.

Level $N^{14}(n,n)N^{14}$ $E_n = 1.9$ to 3.8

σ_{el} 12.93 J = 1/2-

R.Meier, R.Ricamo, P.Scherrer, W.Zünti, Helv. Phys. Acta 26, 451 (1953).

N^{16}
7 9

No 1.0γ (<5% of 6.0γ) 0(fast n) scin

F.Boehm, D.C.Peaslee, V.Perez-Mendez, Phys. Rev. 90,1119(1953).

O^{14}
8 6

γ 2.30 ± 0.03 scin

E_γ agreement with energy of known 2.31 level in N^{14} (I = 0+) shows O^{14} β^+ transition is 0+ ⟶ 0+

W.W.Bell quoted by R.Sherr, J.B.Gerhart, Phys. Rev. 91, 909 (1953).

O^{15}
8 7

Levels $N^{14}(d,n)$ $E_d = 7.7$ ppl

g.s.	$l_p = 1$
5.3	$l_p = 2$?
6.2	$l_p = 1$?
6.8	$l_p = 0$
7.5	$l_p = 1$?
8.4	$l_p = 1$?
9.1	$l_p = 1$?

W.H.Evans, T.S.Green, R.Middleton, Proc. Phys. Soc. 66A, 108(1953).

Levels $N^{14}(p,\alpha)20.4^mC^{11}$ $E_p = 6.6$

11.9	12.5	stacked foils
12.2	13.0	

J.P.Blaser, P.Marmier, M.Sempert, Helv. Phys. Acta 25, 442(1952).

Capture γ's $N^{14}(p,\gamma)$ $E_p = 1.06$ scin

w	1.46
st	3.04
st	5.27
w	6.82
st	8.34

C.W.Li, Phys. Rev. 92, 1084A(1953).

O^{16}
8 8

Level $O^{16}(p,p')$ $E_p = 8$ s

6.0
6.1

Doublet separation = 0.087 ± 0.010

J.C.Arthur, A.J.Allen, R.S.Bender, H.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952).

Level $F^{19}(p,\alpha\gamma)$ $E_p = 0.34$ $\alpha\gamma$

γ (6.13) $\tau \lesssim 10^{-9}$s

S. Gorodetzky, R.Armbruster, A.Gallmann, A.Knipper T.Muller, Compt. rend. 237,45(1953).

Levels $F^{19}(p,\alpha\gamma)$ $E_p = 0.874,\ 0.935$

$\alpha\gamma(\theta)$ (6.91) I = 2 + sπ scin

(7.12) I = 1 −

J.Seed, A.P.French, Phys. Rev. 88, 1007(1952).

Levels $F^{19}(p,\alpha\gamma)$ $D(\gamma,p)$ in ppl

γ polarization (6.91) even

(7.12) odd

L.W.Fagg, S.S.Hanna, Phys. Rev. 88, 1205(1952).

Levels $F^{19}(p,\alpha\gamma)$ $E_p = 0.874,\ 0.935$

p,α(θ) (6.91) I = 2+

(7.12) I = 1-

Neither level contains the 2- state predicted from α-particle model unless separated by <0.003 from above levels

No level between 7.12 and 7.94; 8.11 and 9.12

R.W.Peterson, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 92, 1085A(1953).

Levels $C^{12}(\alpha,\alpha)C^{12}$ $E_\alpha = 0.5$ to 4 pc

$\alpha,\alpha(\theta)$

9.58	J = 1-	$\Gamma = 0.860$
9.84	J = 2+	$\Gamma = 0.001$

R.W.Hill, Phys. Rev. 90,845(1953).

O^{16} 8 8

Levels $N^{15}(p,\alpha)C^{12}$
$\sigma(E)$ 12.43 J = 1−
13.09 J = 1−

W.A.Fowler, R.G.Thomas, Phys. Rev. 91,473A (1953)

Levels $N^{15}(p,\alpha)C^{12}$ E_p = 0.5 to 1.0 pc
$p,\alpha_o(\theta)$ (12.43) J = 0+
(13.09) J = 1−

G.C.Neilson, D.B.James, C.A.Barnes, Phys. Rev. 92, 1084A (1953).

Levels $N^{15}(p,\alpha\gamma)C^{12}$ scin
$p,\gamma(\theta)$ (12.51) J = 2−
(12.95) J = 2−
(13.24) J = 3− or 4+
4.43 γ studied for E_p = 0.43, 0.90, 1.2

C.A.Barnes, D.B.James, G.C.Neilson, Can. J. Phys. 30, 717(1952).

Levels $N^{15}(p,\alpha\gamma)C^{12}$ s
$p,\gamma(\theta)$ (12.51) J = 2 −
$p,\alpha(\theta)$ (12.95) J = 2 −
(13.24) J = 4 +

A.A.Kraus, Jr., A.P.French, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 89, 299(1953).

$O^{16}(\gamma,\alpha)C^{12}$ E_γ = 17.6 ppl
$\sigma(C^{12}$ g.s.$)/\sigma(C^{12}$ 4.4-Mev level) > 90 (cf C^{12})
$\sigma(C^{12}$ g.s.$) = 2.0 \times 10^{-4}$

H.Nabholz, P.Stoll, H.Wäffler, Helv. Phys. Acta 25, 701(1952).

Levels $O^{16}(n,n')$ E_n = 14.1 cc
(~6 Mev excitation)/(~12 Mev excitation) ~5

J.P.Conner, Phys. Rev. 89, 712(1953).

γ's $F^{19}(p,\alpha\gamma)$ E_p=0.874, 0.935 scin
(6.91γ)/(possible 0.78γ from 6.91 level)≥200
(7.12γ)/(possible 0.98γ from 7.12 level)≥120
(7.12γ)/(possible 1.06γ from 7.12 level)≥100
Results consistent with small T=1 admixture in levels involved (expected from Coulomb perturbation)

D.H.Wilkinson, G.A.Jones, Phil Mag. 44, 542(1953).

Resonances $O^{16}(\gamma,4\alpha)$ $E_\gamma \leq 20$ to ≤ 70 ppl
22.6 29.5
25.8

F.K.Goward, J.J.Wilkins, Proc. Phys. Soc. 65A, 671(1952).

Resonances $O^{16}(\gamma,4\alpha)$ $E_\gamma \leq 32$ ppl
22* 29 ?
25
*Alternative modes of disintegration via Be^8, C^{12}

D.L.Livesey, C.L.Smith, Proc. Phys. Soc. 65A, 758(1952).

Reaction $O^{16}(\gamma,\alpha)C^{12}$ $E_\gamma \leq 27$ pp
$\gamma,\alpha(\theta)$ isotropic; ∴ excited states of C^{12} involved.

C.H.Millar, A.G.W.Cameron, Can. J. Phys. 31, 723 (1953).

O^{16} 8 8

Levels
See C^{12}, D.L.Livesey, C.L.Smith, Proc. Phys. Soc. 66A, 689(1953); C.A.Hsiao, V.L.Telegdi, Phys. Rev. 90,494; 91,473A(1953).

O^{17} 8 9

Level $N^{14}(\alpha,p)$ E_α = 4.80 ppl
0.86

E.Hjalmar, H.Slätis, Phys. Rev. 89, 1151(1953).

γ 0.8705 ± 0.0020 $\alpha = 7 \times 10^{-6}$
Value without Doppler correction sl pe− ce−

R.G.Thomas, T.Lauritsen, Phys. Rev. 88,969(1953).

Levels $F^{19}(d,\alpha)$ E_d = 1.8, 2.0 s

0.883	5.229	5.95
3.069	5.397	6.87
3.856	5.723	6.99 ?
4.567	5.875	7.37 ?

Relative intensities given

H.A.Watson, W.W.Buechner, Phys. Rev. 88, 1324 (1952).

$O^{16}(n,n)O^{16}$ E_n = 14.1 cc
$n,n(\theta)$ not isotropic for elastic n's
~ isotropic for inelastic

J.P.Conner, Phys. Rev. 89, 712 (1953).

$O^{16}(n,n)$ E_n = 14.1 cc
$n,n(\theta)$ asymmetrical for elastic n's,
~symmetrical for inelastic

J.P.Conner, Phys. Rev. 89, 712(1953).

F^{17} 9 8

Levels $O^{16}(p,p)O^{16}$ E_p=0.28 to 4.6 pc
$p,p(\theta)$ (3.11) J = 1/2−
(3.88) J = 7/2−?

F.J.Eppling, J.R.Cameron, R.H.Davis, A.S.Divatia, A.I.Galonsky, E.Goldberg, R.W.Hill, Phys. Rev.91, 438A(1953).

F^{18} 9 9

Levels $N(\alpha,\alpha)N$ E_α= 1.5 to 3.4
6.7
6.8

N. P.Heydenburg, G.M.Temmer, Phys. Rev. 91,439A (1953).

Levels $N(\alpha,p)O^{17}$ E_α = 5.30 cc

5.2	6.3	7.2
5.6	6.5	7.4
5.9	6.8	7.6

M.C.Kavadiniz, Rev. fac. sci. Univ. Istanbul 17A,1, (1952).

F^{19} 9 10

Levels $Ne^{21}(d,\alpha)$ E_d = 2.129 s
0.113
0.192

C.Milelkowsky, W.Whaling, Phys. Rev. 88, 1254 (1952).

$F^{19}_{9\ 10}$

Levels $F^{19}(p,p')$ $E_p = 8$ s

1.37	3.94	4.48
1.59	4.06	4.59
2.82	4.41	4.76

J.C.Arthur, A.J.Allen, R.S.Bender, H.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952).

γ's $F^{19}(n,n'\gamma)$ $E_n = 2.5$ scin

0.084
0.114
0.199
1.36

R.B.Day, Phys. Rev. 89, 908A(1953).

Levels $O^{18}(p,\alpha)N^{15}$ pc
$p,\alpha(\theta)$

Level	E_o	J
8.48	0.560	1/2 ∓ or 3/2 ∓
8.56	0.640	3/2 ∓
~8.6	~0.7*	1/2 ±
8.76	0.850	1/2 ±

*Broad background of one or more levels

A.V.Cohen, Phil. Mag. 44, 583(1953).

Levels $O^{18}(p,n)F^{18}$ $E_p = 2.6$ to 3.8

10.472	10.958	11.265
10.543	11.052	11.427
10.587	11.162	11.513
10.844		

H.Mark, C.Goodman, Phys. Rev. 92,1097A(1953).

$F^{19}(\gamma,n)F^{18}$ n yield

Yield curve analyzed into straight line segments
Breaks at $E_\gamma = 11, 11.5, 11.9, 15.3$

J.Goldemberg, L.Katz, Phys. Rev. 92,852A(1953).

$F^{20}_{9\ 11}$

β^- 5.41 F-K plot linear
γ 1.631
No $\beta^- > 5.4$ (< 1%) No $\gamma > 1.67$ (< 0.25%)
F^{19}(1.8-Mev d,p); sl pe-

D.E.Alburger, Phys. Rev. 88, 1257(1952).

Level $F^{19}(d,p)$ $E_d = 14.3$
$d,p(\theta)$ g.s. $l_n = 2$

C.F.Black, Phys. Rev. 90,381A(1953).

Levels $F^{19}(d,p)$ $E_d = 3.6$ ic
$d,p(\theta)$ g.s. $l_n = 0$ and 2
(0.65) $l_n = 2$
(~2.05) $l_n = 2$
(~3.49) $l_n = 0$

D.A.Bromley, J.A.Bruner, H.W.Fulbright, Phys. Rev. 89, 396(1953).

Levels $F^{19}(d,p)$ $E_d = 1.5$ to 2.1 s

0.652	1.309	2.870	3.586	4.275
0.828	1.970	2.966	3.681	4.310
0.938	2.048	3.491	3.961	5.062?
1.059	2.195	3.528	4.079	

Relative intensities given

H.A.Watson, W.W.Buechner, Phys. Rev. 88, 1324 (1952).

$F^{21}_{9\ 12}$

τ 5^s F^{19}(fast t)

E.C.Campbell, J.E.Strain, ORNL-1496 (1952)

$Ne^{20}_{10\ 10}$

Level $Na^{23}(p,\alpha)$ $E_p = 1.46, 2.92$ EA
1.634

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

Level $F^{19}(p,\gamma)$ $E_p = 0.70$ scin
(>7.5γ) (γ) 1.66
(~100% of radiative captures go through 1.66 level)

G.A.Jones, D.H.Wilkinson, Proc. Phys. Soc. 65A,1055, (1952).

Level $Na^{23}(p,\alpha\gamma)$ $E_p = 1.255$
$\alpha\gamma(\theta)$ (1.63) I = 2+ s, scin

J.Seed, Phil. Mag. 44,921 (1953).

Level $Ne^{20}(d,d')$ $E_d = 7.8$ ppl
$d,d'(\theta)$ 1.66 $l_d = 1$
From theory of Huby and Newns analogous to Butler stripping theory

R.Huby, H.C.Newns, Phil Mag. 42,1442(1951); R.Middleton, C.T.Tai, Proc. Phys. Soc. 64A, 801, (1951).

Levels $O^{16}(\alpha,\alpha)O^{16}$ $E_\alpha = 0.94$ to 4.0 pc
$\alpha,\alpha(\theta)$

	J	Γ(kev)
6.74	0+	24
7.18	3-	10
7.22	0+	5
7.45	2+	10
7.85	2+	3

J.R.Cameron, Phys. Rev. 90, 839; 89,909A(1953).

$F^{19}(p,\gamma)Ne^{20}$ EA

Resonance 0.2244±0.0004 Γ = 1 kev
Level 13.083 absolute measurement

S.E.Hunt, W.M.Jones, Phys. Rev. 89, 1283 (1953).

Resonances $F^{19}(p,\alpha\gamma)O^{16}$
0.3404 ± 0.0004 Γ = 2.9 kev
0.4831 ± 0.0005 Γ = 2.2 kev

S.E.Hunt, Proc. Phys. Soc. 65A, 982(1952).

$F^{19}(p,\alpha\gamma)O^{16}$ s

Resonance 0.8725 ± 0.0018
Level 13.699 absolute measurement

K.F.Famularo, G.C.Phillips, Phys. Rev. 91,1195(1953).

Resonances $F^{19}(p,\alpha\gamma)O^{16}$ s π scin

		J
$\alpha\gamma(\theta)$	0.669	1 +
$\alpha\gamma(\theta)$; $p,\gamma(\theta)$	0.874	2 −
$\alpha\gamma(\theta)$	0.935	1 +

J.Seed, A.P.French, Phys. Rev. 88, 1007(1952).

$^{20}_{10}Ne_{10}$

Resonances $F^{19}(p,\alpha)O^{16}$g.s. pc

$p,\alpha(\theta)$

	J	Rel. Yield	Γ
1.09		0.13	0.03
1.23		0.28	0.08
1.38	2 +	1.0	0.10
1.73	0 +	3.0	0.10
1.91	1 −	6.0	0.20

E.B.Paul, R.L.Clarke, W.T.Sharp, Phys. Rev. 90,381A(1953); verbal report.

$^{21}_{10}Ne_{11}$

Levels $Ne^{20}(d,p)$ $E_d = 7.8$ ppl

$d,p(\theta)$

	I	l_n
g.s.	$d_{3/2}$ *	2
(0.33)	$d_{5/2}$ *	2
(1.68)		0 or 1
(2.79)		0

For levels at 3.73, 4.71, 5.44, 5.74, 7.30, $l_n = 1$ or 2

*From relative cross-sections

R.Middleton, C.T.Tai, Proc. Phys. Soc. 65A, 752 (1952).

$^{22}_{10}Ne_{12}$

Levels $F^{19}(\alpha,p)$ $E_\alpha = 5.30$ ppl

0.57
1.34
2.84

E.Hjalmar, H.Slätis, Arkiv Fysik 4, 323(1952).

Na

Neutron resonance (ev) $E_n = 1$ ev to 10 kev

~3500 $\sigma_o\Gamma^2 = 58 \times 10^6$

E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1953).

$^{21}_{11}Na_{10}$

τ 27^s Na(≤70-Mevγ)

β^+ 2.5 scin

F.I.Boley, Iowa State Coll. J. Sci. 27, 129(1953)

Levels $Ne(p,p')Ne$ E_p=0.2 to 4.4 pc

4.20	5.04	5.58
4.31	5.50	6.48
4.48	5.83	

W.Haeberli, A.Galonsky, E.Goldberg, R.Douglas, Phys. Rev. 91, 438A; 91, 439A (1953).

$^{22}_{11}Na_{11}$

β^+ 100† 0.540 s

0.06† 1.83 D_2 fits spectral shape

B.T.Wright, Phys. Rev. 90,159;89,902A(1953).

$\epsilon_k/\beta^+ = 0.09$ $\beta^+\gamma$ scin pc

R.H.Miller, R.Sherr, Phys. Rev. 92, 848A (1953).

γ (1.28) $\alpha = 7 \times 10^{-6}$ s ce⁻

G.Hinman, D.Brower, R.Leamer, Phys. Rev. 90,370A(1953).

$^{23}_{11}Na_{12}$

Level $Na^{23}(p,p')$ $E_p = 1.46$ EA

0.439

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

$^{23}_{11}Na_{12}$

Levels $Ne(p,p)Ne$ E_p=2.4 to 3.6 pc

11.14	11.56
11.36	11.87
11.53	

W.Haeberli, A.Galonsky, E.Goldberg, R.Douglas, Phys. Rev. 91, 438A; 91, 439A (1953).

$^{24}_{11}Na_{13}$

I 4 M

μ +1.690

$\Delta F = \pm 1, \Delta m = \pm 1$ transitions studied

$\Delta\nu(Na^{24}) / \Delta\nu(Na^{23}) = 1139.35/1771.61$

E.H.Bellamy, K.F.Smith, Phil. Mag. 44, 33(1953).

τ $14.97^h \pm 0.02$ Na(pile n)

Counted for 5 half-lives with β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No.3, 14(1953).

Level $Na^{23}(d,p)$ E_d= 1.15 ppl

$d,p(\theta)$ g.s. l_n= 2

S.Takemoto, T.Dazai, R.Chiba, Phys. Rev. 91,1024 (1953).

γ (1.38) $\tau < 2 \times 10^{-9}$ s $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259 (1953).

γ 1.3679 ± 0.0010 s$\pi\sqrt{2}$ pe⁻

2.7535 ± 0.0010

A.Hedgran, D.Lind, Arkiv Fysik 5, 177(1952).

γ 2.753 ± 0.005 pair s

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31,537 (1953).

γ (1.38) α_{pair}=0.6 x 10^{-4} E2 sl

(2.76) α_{pair}=7.1 x 10^{-4} E2

S.D.Bloom, Phys. Rev. 88, 312(1952); 87, 236A(1952); 87, 181(1952).

γ (1.38) α_{pair}= 3 x 10^{-5} E2 sl

(2.76) α_{pair}= 8 x 10^{-4} E2

H.Slätis, K.Siegbahn, Arkiv Fysik 4, 485(1952).

Levels $Na^{23}(d,p)$ ppl

0.472	3.409	3.899
0.564	3.582	3.929
1.341	3.623	4.184
1.844	3.648	4.202
1.884	3.738	4.219
2.464	3.850	4.558
2.561		

A.Sperduto, W.W.Buechner, Phys. Rev. 88, 574 (1952).

Capture γ's $Na^{23}(n,\gamma)$ 2 crystal scin s

50†	0.48	5†	1.66
18†	0.86	11†	2.0
10†	1.34	24†	2.53

†Photons per 100 n captures

J.T.Braid, Phys. Rev. 90,355A(1953); verbal report.

Na^{24} 11 13

Capture γ's $Na^{23}(n,\gamma)$ sl pe⁻, Cpt

60†	0.475	20†	2.07
50†	0.877	30†	2.52
20†	1.75		

†Photons per 100 n captures

H.T.Motz, Phys. Rev. 90,355A(1953); verbal report.

Neutron resonances E_n = 0.12 to 1

12 resonances, Γ's, J's

P.H.Stelson, W.M.Preston, Phys. Rev. 88, 1354 (1952).

Mg

Capture γ's Mg(n,γ) 2 cryst scin

1.07?
1.9
2.8

T.H.Braid, Phys. Rev. 91, 442A(1953); verbal report.

Levels Mg(p,p') E_p = 8 s

3.54
4.71
5.03

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Mg^{24} 12 12

Resonance $Na^{23}(p,\alpha\gamma)Ne^{20}$

(α)(1.63γ)(θ) 1.255 J = 1+ s scin

No g.s. α's observed

J.Seed, Phil. Mag. 44, 921 (1953).

Level Mg(n,n'γ) E_n = 2.5

γ 1.365 scin

R.B.Day, Phys. Rev. 89, 908A(1953).

Level Mg(p,p') E_p = 2.41 EA

1.371 ± 0.002

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

Level Mg^{24}(d,d')

d,d'(θ) (1.38) l_n = 2

From theory of Huby and Newns analogous to Butler stripping theory

R.Huby, H.C.Newns, Phil. Mag. 42, 1442(1951); J.R.Holt, C.T.Young, Nature 164,1000(1949).

Levels Mg(p,p') Al(p,α) E_p = 8 s

1.38
4.13
4.24

g.s. α group not observed

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Level Mg(n,n'γ) E_n = 14 scin n'γ

γ 1.44

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 91, 441A (1953); verbal report.

Mg^{24} 12 12

Capture γ's $Na^{23}(p,\gamma)$ E_p = 0.305 scin

28 †	1.38	≤5 †	5.8
≤4 †	2.41 ?	≤2 †	6.2
24 †	2.88 ?	20 †	6.8
	~3.6		7.5
	4.2	11 †	10.3

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809 (1953).

Mg^{25} 12 13

Levels Mg^{24}(d,p) E_d = 8 pc

d,p(θ)15.4 †	g.s.	l_n = 2
8.2 †	(0.58)	l_n = 0
8.2 †	(0.98)	l_n = 0
	(1.61)	isotropic
5.5 †	(1.96)	l_n = 2
	(~2.7)	l_n = 0
8.7 †	(3.40)	l_n = 1
	4.62	
	5.05	
	5.49	
	6.40	

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 258 (1953).

Levels Mg(p,p') E_p = 8 s

0.61	2.76	complex ?
1.62	3.41	
1.98	3.91	
2.56		

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Capture γ's Mg(n,γ) pair s

3.918
3.5† 6.358

Assignment by agreement with d,p results
† Photons per 100 n captures in Mg
Other lines not remeasured

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 901 (1953).

Mg^{26} 12 14

Levels Mg^{25}(d,p) E_d = 8 pc

d,p(θ) ~2 †	g.s.	
13 †	(1.83)	l_n = 0(60%), 2(40%)
5.7 †	(2.97)	l_n = 0
6.1 †	(3.97)	l_n = 0
5.6 †	(4.35)	l_n = 0
3.3 †	(6.15)	l_n = 0
	7.29	
	8.28	

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 258 (1953).

Levels $Na^{23}(\alpha,p)$ E_α = 5.30 ppl

0.40
1.72
2.72

E.Hjalmar, H.Slätis, Arkiv Fysik 4, 323(1952).

Levels Mg(p,p) s

1.83
2.96

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Mg^{26}
12 14

Levels $Na^{23}(\alpha,p\gamma)$ $p\gamma$ scin

		γ's	
1.83	1.83		
2.97	1.14(6†)	(2.97)(1†)	1.83(6†)
3.97	2.14	(3.97)(vw)	1.83
4.35	1.38	1.14	1.83

Presence of 0.44 level in doubt

J.E.May, B.P.Foster, Phys. Rev. 90,243; 90,370A (1953).

Mg^{27}
12 15

τ $9.39^m \pm 0.03$ Mg(pile n)
Counted with β electroscope

K.J.Bobin, E.E.Lockett, quoted by E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

τ $9.45^m \pm 0.03$ Mg(pile n)
Counted with β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

τ		$9.51^m \pm 0.03$	
β^-	41.4%	1.59	s
	58.2%	1.75	
	0.4%	2.6	
γ		0.84	s pe^- scin
		1.02	

(1.59β)(1.02γ) (1.75β)(0.84γ) scin
No $\gamma\gamma$ (< 0.5%)

H.Daniel, L.Koester, Th. Mayer-Kuckuk, Z.Naturf. 8A, 447 (1953).

Levels $Mg^{26}(d,p)$ $E_d = 8$ pc

d,p(θ)	2.8 †	g.s.	$l_n = 0$
	4.6 †	(0.99)	$l_n = 2$
		3.50	$l_n = 0$

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 258(1953).

Capture γ Mg(n,γ) pair s
13† 6.440

Assignment by agreement with d,p results
†Photons per 100 n captures in Mg^{26}
Other lines not remeasured

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 901 (1953).

Mg^{28}
12 16

τ 20.8^h Si,K(420-Mev p)
β^- 0.42 F-K plot linear chem; sl
No other β($\leqslant$10%)

L.Marquez, Phys. Rev. 90, 330 (1953).

τ 22.1^h Si(350-Mev p)
p 2.3^mAl chem
β^- 0.3 a
Several γ's up to 2.6 scin

J.W.Jones, T.P.Kohman, Phys. Rev. 90, 495(1953).

Mg^{28}
12 16

τ		21.4^h		Mg(56-Mev α)
β^-		0.39		a
γ	70†	0.032	α<1	scin

†Photons per 100 Mg^{28} decays

A.H.Wapstra, A.L.Veenendaal, Phys. Rev. 91, 426 (1953).

τ 21.3^h p 2.3^mAl Mg(39-Mev α)
Si($\leqslant$100-Mev γ) chem

R.K.Sheline, N.R.Johnson, Phys. Rev. 89, 520(1953).

τ 21.2^h p 2.3^mAl chem
β^- ~0.4 Cl(340-Mev p) chem
γ 0.027 pc
Other γ's in agreement with Sheline, Johnson
M.Lindner, Phys. Rev. 91, 642; 89, 1150 (1953).

τ 21.8^h p 2.3^mAl Mg(t,p) chem
γ 0.391 scin
~1
~1.3

E.Iwersen, W.S.Koski, F.Rasetti, Phys. Rev. 91, 1229 (1953).

β^-		0.40	Mg(39-Mevα)	a
γ		~0.03	chem	scin
	30†	0.40		
	28†	0.95		
	71†	1.35		

R.K.Sheline, N.R.Johnson, Phys. Rev. 90, 325, (1953).

Al^{24}
13 11

τ 2.10^s Mg(20-Mev p)
γ 2.9 scin
4.3
5.3
7.1

N.W.Glass, L.K.Jensen, J.R.Richardson, Phys. Rev. 90, 320 (1953).

Al^{25}
13 12

τ 7.6^s Mg^{24}(0.418-Mev p)

J.L.W.Churchill, W.M.Jones, S.E.Hunt, Nature 172, 460 (1953).

Levels $Mg^{24}(d,n)$ $E_d = 3.97$ ppl

d,n(θ)	g.s.	$l_p = 2$
	0.45	$l_p = 0$
	0.95	$l_p = 1$ or 2
	1.81	
	1.94 ?	
	2.51	
	2.70	
	2.92 ?	
	3.09	

E.Goldberg, Phys. Rev. 88, 159A(1952); 89, 760 (1953).

$Al^{25}_{13\ 12}$

Capture γ's Mg(p,γ) E_p = 0.27 scin

~6 †	0.48
6 †	1.95
2 †	2.35

No higher energy γ's observed

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809 (1953).

Resonance $Mg^{24}(p,\gamma)Al^{25}$ EA

0.4180±0.0005 Γ = 0.0040

absolute measurement

S.E.Hunt, W.M.Jones, Phys. Rev. 89,1283(1953).

$Al^{26}_{13\ 13}$

τ 6.7^s Mg^{25}(0.392-Mev p)

J.L.W.Churchill, W.M.Jones, S.E.Hunt, Nature 172, 460 (1953).

$Al^{27}_{13\ 14}$

Q +0.149 I

H.Lew, G.Wessel, Phys. Rev. 90, 1 (1953).

Levels Al(n,n′) E_n = 2.4 scin

0.35 ?

~0.9

M.J.Poole, Phil. Mag. 43, 1060(1952).

Level Al(p,p′) E_p = 2.31 EA

0.843

D.J.Donahue, K.W.Jones, M.T.McEllistrem, H.T. Richards, Phys. Rev. 89, 824(1953).

Levels Al(n,n′γ) E_n = 2.5 scin

γ

0.843

1.018

2.20

R.B.Day, Phys. Rev. 89, 908A(1953).

Levels Al(n,n′γ) E_n = 14 scin

γ n′γ

0.81 ?

1.03

2.34

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 91,441A (1953); verbal report.

Resonances $Mg^{26}(p,\gamma)Al^{27*}$ EA

		Γ
	0.3148±0.0005	0.004
	0.3385±0.0005	0.002
	0.3894±0.0005	0.004
	0.4365±0.0004	0.004
	0.4542±0.0003	<0.001
(Al^{27}?)	0.484 ±0.0010	0.010

absolute measurement

*Assignment from Tangen who found no β^+

S.E.Hunt, W.M.Jones, Phys. Rev. 89,1283(1953).

Capture γ's Mg(p,γ) E_p = 0.336 scin

35†	2.8
45†	5.8

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809(1953).

$Al^{28}_{13\ 15}$

τ 2.27^m ± 0.02 Al(pile n)

Counted 5 samples each for 5 half-lives

R.M.Bartholomew, F.Brown, W.D.Howell, W.R.J. Shorey, L.Yaffe, Can. J. Phys. 31,714(1953).

β^- 2.85 d 21^h Mg chem; sl

F-K plot linear

L.Marquez, Phys. Rev. 90,330 (1953).

γ 1.78 d 21^h Mg scin

R.K.Sheline, N.R.Johnson, Phys. Rev. 90,325(1953)

Levels Al^{27}(d,p) E_d ~8 pc

d,p(θ)

	l_n
g.s. doublet	0
(1.0)	0 (10%), 2 (90%)

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 65A, 763 (1952).

Levels Al(d,p) E_d = 2.1 s ppl

0.031	2.652	3.873	4.734	5.372
0.974	2.980	3.900	4.759	5.435
1.015	3.006	3.932	4.837	5.735
1.367	3.291	4.031	4.898	5.755
1.625	3.342	4.115	4.988	5.792
2.137	3.458	4.238	5.007	5.855
2.198	3.532	4.307	5.128	6.011
2.268	3.587	4.457	5.156	6.190
2.484	3.665	4.512	5.169	6.307
2.578	3.695	4.686	5.182	

Relative intensities given

H.A.Enge, W.W.Buechner, A.Sperduto, Phys. Rev. 88, 963(1952).

$Al^{29}_{13\ 16}$

γ scin

85†	1.28
15†	2.43

No 2.04γ (< 4%)

H.Roderick, O.Lönsjö, W.E.Meyerhof, Phys. Rev. 90, 371A(1953).

Si

Relative abundances SiF_4; ms

A	28	29	30
%	92.18	4.71	3.12

J.H.Reynolds, Phys. Rev. 90,1047 (1953).

$Si^{27}_{14\ 13}$

τ 4.45^s Si(≤25-Mev γ)

R.G.Summers-Gill, R.N.Haslam, L.Katz, Can. J.Phys. 31,70 (1953).

$Si^{28}_{14\ 14}$

Resonances $Al^{27}(p,\alpha)Mg^{24}$ $Al^{27}(p,\gamma)Si^{28}$ s

E_o	α_o/γ†
0.503	1.3
0.630	1.1
0.652	<0.1
0.677	<0.3
0.728	4.2
0.733	<0.3

E_p = 0.40 to 0.75

†(yield α's to Mg^{24}g.s.)/(yield ~12.1 E_γ to Si^{28}g.s.)

J.G.Rutherglen, R.D.Smith, Proc. Phys. Soc. 66A, 800(1953).

$Si^{28}_{14\ 14}$ Capture γ's $Al^{27}(p,\gamma)$ $E_p = 0.325, 0.404$

12 †	1.81	~14 †	7.1 scin
12 †	2.82		7.5
5 †	4.65		
	5.0		

H.Casson, Phys. Rev. 87, 215A(1952); 89, 809 (1953).

Resonances $Al^{27}(p,\gamma)Si^{28}$ EA

	Γ
0.226±0.0015	~0.001
0.2941±0.0005	<0.001
0.3256±0.0004	<0.001
0.4047±0.0004	0.0007
0.4385±0.0005	<0.001
0.5040±0.0008	0.0007

absolute measurements

S.E.Hunt, W.M.Jones, Phys. Rev. 89,1283(1953).

Resonances $Mg^{24}(\alpha,p)Al^{27}$ $Al^{27}(p,\alpha)Mg^{24}$
Same Si^{28} levels observed in both reactions
Resonances $Mg^{24}(\alpha,\alpha)$ $E_\alpha = 2.7$ to 3.4

S.G.Kaufmann, G.Goldberg, L.J.Koester, F.P.Mooring, Phys. Rev. 88, 673(1952).

$Si^{29}_{14\ 15}$ Levels Si(d,p) $E_d = 14.3$
d,p(θ) g.s. $l_n = 0$
(1.29) $l_n = 2$

C.F.Black, Phys. Rev. 90,381A(1953).

Levels Si(d,p) $E_d = 8.21$ a pc
d,p(θ)

	l_n	$d\sigma/d\Omega$†
g.s	0	62
(1.278)	2	6.2
(2.027)	2	2.4
(2.426)	*	0.7
(3.070)	2	1.2
(3.623)	3	4.0
(4.934)	1	55
(6.380)	1	32

†mb/sterad at maximum of angular distribution
*angular distribution isotropic

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A,467 (1953); Phys. Rev. 89,665(1953).

$Si^{29?}_{14\ 15}$ Capture γ's Si(n,γ) 2 cryst scin
1.26
2.13

T.H.Braid, Phys. Rev. 91, 442A(1953); verbal report.

Resonances Mg(α,n)Si $E_\alpha = 5.3$ a
4.6
4.8
Excitation function given

J.Nagy, Acta Physica Acad. Sci. Hung. 3,15(1953).

$Si^{30}_{14\ 16}$ Levels Si(d,p) $E_d = 8.21$ a pc
d,p(θ) (5.07) l_n=0
(5.50) l_n=0 or 2

J.R.Holt, T.N.Marsham, Proc, Phys. Soc. 66A,467 (1953).

$Si^{31}_{14\ 17}$ τ 2.62^h
β^- 1.48 a

A.Wennerblom, K.E.Zimen, E.Ehn, Svensk Kem. Tid. 63, 207(1951).

τ 2.62^h P(d,2p) chem; ic

L.J.de Vries, F.T.H.Veringa, J.Clay, Koninkl. Ned. Akad. Wetenschap., Proc. 55B, 303(1952).

$Si^{31?}_{14\ 17}$ Levels Si(d,p) $E_d = 8.21$ a pc
d,p(θ) (0.757) l_n=0
(1.699) l_n=0 or 2

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A,467 (1953).

$Si^{32}_{14\ 18}$ Abundance $<4\times10^{-6}$% of natural silicon
No P^{33} β's observed, $Si^{32}(n,\gamma)$ $Si^{33} \rightarrow P^{33}$
Assumed $\sigma(n,\gamma) = 0.05$

A.Turkevich, A.Tompkins, Phys. Rev. 90,247(1953).

τ ~700^{y*} Cl(340-Mev p) chem
β^- ~0.10 p 14.3^d P a
No γ a
*Assuming $\sigma[Cl(p,\alpha 2p)Si^{32}] = \sigma[Cl(p,\alpha n2p)Si^{31}]$

M.Lindner, Phys. Rev. 91,642;89,1150(1953).

$P^{28}_{15\ 13}$ τ 0.28^s Si(20-Mev p)
β^+ scin
γ 7
No α (< 10% of γ)

N.W.Glass, L.K.Jensen, J.R.Richardson, Phys. Rev. 90, 320 (1953).

$P^{29}_{15\ 14}$ τ 4.45^s Si^{28}(2.8-Mev d)
γ 0.5% (1.28) scin
2.5% (2.43)
(1.28γ)(0.511γ) (2.43γ)(0.511γ)
No 0.39, 0.76, 1.15, or 2.04γ

H.Roderick, O.Lönsjö, W.E.Meyerhof, Phys. Rev. 90, 371A(1953).

β^+ 3.9 Si(6-Mev d)scin

M.Nahmias, T.Yuasa, Compt. rend. 236,2399(1953).

$P^{30}_{15\ 15}$ τ 2.52^m Al(α,n)

K.Baskova, A.Kudriavtseva, Zhur. Ekspti' i Teoret. Fiz. 23, 483(1952).

$P^{31}_{15\ 16}$ Neutron resonances P(n,p)2.6^hSi
$E_n = 2.05$ to 3.25

2.25	2.55	2.87	3.15
2.37	2.70	3.02 ?	3.22

I.Nilsson, Trans. Chalmers Univ. Technol., Gothenburg No. 125(1952).

$P^{32}_{15\ 17}$ τ $14.50^d \pm 0.04$ P(pile n)
Counted for 5 half-lives with β electroscope
No estimate of P^{33} contamination given

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

P^{32} 15 17

$\bar{E}_\beta = 0.694 \pm 0.025$ ic and 4π counter

J.M.Brabant, L.W.Cochran, R.S.Caswell, Phys. Rev. 90, 340A(1953).

e^+/e^- (H_ρ = 1600) < 10^{-5} s

G.W.McClure, Phys. Rev. 91, 483A (1953).

No nuclear γ E_γ= 0.05-0.9(<10^{-4}) scin
From agreement between measured and theoretical bremsstrahlung spectra

M.Goodrich, J.S.Levinger, W.Payne, Phys. Rev. 91, 1225 (1953).

Continuous γ spectrum scin
$\gamma(E_\gamma > 0.09)/\beta^- = 0.0023$

P.Boigiano, L.Madansky, F.Rasetti, Phys. Rev. 89, 679(1953).

Levels	P^{31}(d,p)		E_d = 14.3
d,p(θ)	g.s.	l_n = 2	
	~1.2	l_n = 0	

C.F.Black, Phys. Rev. 90, 371A(1953); verbal report.

Levels	P^{31}(d,p)		E_d = 7.8	pc
d,p(θ)	g.s.	l_n = 2		
	(0.08)	l_n = 2		
	(0.52)	l_n = 0(22%),	2(78%)	
	(1.16)	l_n = 0(33%),	2(67%)	
	(1.3)	l_n = 0(57%),	2(43%)	

J.S.King, E.H.Beach, Phys. Rev. 90, 381A(1953); verbal report.

Capture γ's	P^{31}(n,γ)	2 crystal scin s
37†	0.51	
17†	1.13	
41†	2.19	

†Photons per 100 n captures

J.T.Braid, Phys. Rev. 90,355A(1953); verbal report.

P^{33} 15 18

τ	25^d	S^{33}(n,p)	chem
β^-	0.246		a
No γ (<3.5%)			

T.Westermark, Phys. Rev. 88, 573(1952).

S^{32} 16 16

Level	S(n,n'γ)	E_n = 2.5	scin
γ	2.23		

R.B.Day, Phys. Rev. 89, 908A(1953).

Level	S(n,n'γ)	E_n = 14	scin
γ	2.32		n'γ

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 91, 441A (1953); verbal report.

Levels	S^{32}(p,p')		E_p = 8	s
	2.25	4.50	5.04	
	3.81	4.74	5.83	
	4.32			

J.C.Arthur, A.J.Allen, R.S.Bender, H.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952); 87, 237A (1952).

S^{32} 16 16

Resonances	P^{31}(p,γ)		E_p= 1.03 to 2.1
p,$\gamma(\theta)$	1.17	J = 2 ±	scin
	1.27	J = 2 ±	
	1.90	J = 1 -	

H.E.Gove, E.B.Paul, Phys. Rev. 92, 852 W (1953).

S^{33} 16 17

q -0.050 S; quad res

H.G.Dehmelt, Phys. Rev. 91, 313 (1953).

Levels	S(d,p)		E_d = 14.3
d,p(θ)	g.s.	l_n = 2	
	(0.79)	l_n = 0	

C.F.Black, Phys. Rev. 90,381A(1953).

Levels	S^{32}(d,p)	E_d= 8.18	a pc
d,p(θ)	l_n	$d\sigma/d\Omega$†	
	g.s.	2	7.1
	0.85	0	39
	1.86	*	0.8
	2.28	*	1.3
	2.90	3	14
	3.26	1	83
	3.91	—	1.5
	4.21	1	15
	4.89	1	9.4
	5.72	1	100
	6.48**	1and2	41
	7.44		
	7.83		

† Relative at maximum of angular distribution
* Angular distribution isotropic
** Level is a doublet

J.R.Holt. T.N.Marsham, Proc. Phys. Soc. 66A, 467 (1953); Phys. Rev. 89, 665(1953).

Level	A^{36}(n,α)	E_n=2.15 to 4.40
	1.1 ± 0.2	pc

B.J.Toppel, S.D.Bloom, Phys. Rev. 91,473A(1953).

Capture γ's	S(n,γ)	2 crystal scin s
60†	0.84	
	~1.52	
40†	2.34	

†Photons per 100 n captures

J.T.Braid, Phys. Rev. 90,355A(1953); verbal report.

Cl^{32} 17 15

τ	0.306^s	S(20-Mev p)
β^+		scin
γ	4.8	
No α (< 10% of γ)		

N.W.Glass, L.K.Jensen, J.R.Richardson, Phys. Rev. 90, 320 (1953).

Cl^{33} 17 16

β^+	4.2	S(6-Mev d)
		scin

M.Nahmias, T.Yuasa, Compt. rend. 236,2399(1953).

Cl^{33} 17 16

Levels S(d,n) $E_d = 8$ ppl
d,n(θ)

g.s.	$l_p = 2$
0.76	$l_p = 0$
~1.89	
2.84	$l_p = 1$
4.22	$l_p = 1$

R.Middleton, F.A.El-Bedewi, C.T.Tai, Proc. Phys. Soc. 66A, 95(1953).

Resonances $S^{32}(p,p)S^{32}$ E_p = 1.0 to 2.8
p,p(θ) 1.90 J=3/2- $\Gamma < 0.025$
2.31 J=1/2- $\Gamma \sim 0.06$

A.J.Ferguson, H.E.Gove, Phys. Rev. 91,439A(1953).

Cl^{34} 17 17 33^m

τ_1 32.5^m S(p,n)

N.M.Hintz, N.F.Ramsey, Phys. Rev. 88, 19(1952).

γ IT 0.145 α = 0.16 M3 scin
$(0.145\gamma)/\beta+$ = 0.45 Cl ($\leqslant$32-Mev γ)

P.Stähelin, P.Preiswerk, Nuovo Cim. 10, 1219(1953).
W.Arber, P.Stähelin, Helv. Phys. Acta 26,433(1953).

1.5^s τ_2 1.45^s Cl ($\leqslant$32-Mev γ)
$\sigma(1.5^s Cl)/\sigma(33^m Cl)$ = ~1.7 $E_\gamma \leqslant 16$ to $E_\gamma \leqslant 32$
4.45 β^+ assigned to this activity
Conclude 4.45 β^+ is 0+ $\longrightarrow$ 0+ (log ft = 3.4)

P.Stähelin, P.Preiswerk, Nuovo Cim. 10,1219(1953).
W.Arber, P.Stähelin, Helv. Phys. Acta 26,433(1953).

Cl^{35} 17 18

μ 0.82111 I
$\nu(Cl^{35})/\nu(Rb^{85})$ = 1.01481 ± 0.00005
$\mu(Cl^{35})/\mu(Cl^{37})$ = 1.20128 ± 0.00006
LiCl, RbCl

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

Cl^{36} 17 19

Level Cl(d,p) E_d = 6.9
d,p(θ) g.s. $l_n = 2$

J.S.King, W.C.Parkinson, Phys. Rev. 88, 141(1952).

Capture γ's Cl(n,γ) 2 crystal scin s

0.48	1.85
0.75	2.15
1.14	2.84

J.T.Braid, Phys. Rev. 90,355A(1953); verbal report.

Capture γ's Cl(n,γ) 2 cryst scin s

35†	0.70	14†	2.40
29†	1.12	10†	2.68
19†	1.77	23†	3.71
	2.03		4.67

W.A.Reardon, R.W.Krone, R.Stump, Phys. Rev. 91, 334; 91,442A (1953).

Capture γ's Cl(n,γ) scin

0.784	2.00
1.15	6.2
1.59	7.7

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Cl^{37} 17 20

μ 0.68352 I
$\nu(Cl^{37})/\nu(Rb^{85})$ = 0.84477 ± 0.00005
LiCl, RbCl

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

A

Neutron resonances (Mev) E_n=0.4 to 1.1

	σ_o
0.58	~3.5
0.60	~3.5
0.74	~3.5

J.B.Guernsey, C.Goodman, Phys. Rev. 91,440A(1953); verbal report.

A^{37} 18 19

τ 32^d A^{36}(pile n)
E_{dis} 0.815 scin a
continuous γ endpoint

C.E.Anderson, G.W.Wheeler, W.W.Watson, Phys. Rev. 90, 606 (1953).

A^{38} 18 20

A^{36}/A^{38} variation of >300% for various pitchblende ores suggests A^{38} formation by α's or fission n's

W.H.Fleming, H.G.Thode, Phys. Rev. 90,857(1953).

A^{41} 18 23

γ (1.3) τ = $6.6 \times 10^{-9 s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259 (1953).

K

Capture γ's K(n,γ) 2 cryst scin

0.77 ($K^{40,42}$)	2.03 (K^{40})
1.19 (K^{42})	2.80
1.61	~3.45

Assignments from agreement with d,p results

T.H.Braid, Phys. Rev. 91, 442A (1953).

K^{40} 19 21

β^- 1.4 ± 0.1 $\Delta I = 4$, yes shape
liquid argon ic

J.H.Marshall, Phys. Rev. 91, 905; 90, 371A(1953).

ϵ/β^- = 0.060 ± 0.006 ms of argon
5 samples. Ages from Pb ratios of nearby uraninites. Assumed τ_{total} = $1.28 \times 10^{9 y}$

R.D.Russell, H.A.Shillibeer, R.M.Farquhar, A.K. Mousuf, Phys. Rev. 91, 1223(1953); A.K.Mousuf, Phys. Rev. 88, 150 (1952).

γ's/sec/gm K = 3.63 ± 0.10 ic

P.R.J.Burch, Nature 172, 361 (1953).

$\Delta M(K^{40} - Ca^{40})$ = 1.30 ±0.07 Mev ms
$\Delta M(K^{40} - A^{40})$ = 1.49 ±0.07 Mev

W.H.Johnson, Jr., Phys. Rev. 88, 1213(1952).

Levels K(d,p) E_d= 5.65
0.032 s
0.800
0.893

W.W.Buechner, A.Sperduto, C.P.Browne, C.K.Bockelman, Phys. Rev. 91, 1502 (1953).

K^{40}
19 21

Capture γ's K(n,γ) pair s

4†	4.39	4 †	5.66
3†	5.06	6 †	5.74
2†	5.18	1.3†	6.994
6†	5.38	3.5†	7.757*
2.5†	5.50		

Assignment from agreement with d,p results and intensities
*Intensity indicates goes to 0.032 level
†Photons per 100 n captures in K

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 927 (1953).

$K^{40?}$
19 21

Capture γ's K(n,γ) scin
6.0
8.2

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

K^{41}
19 22

Capture γ's K^{40}(n,γ) pair s
0.10† 8.45 enriched K^{40}, 0.022%
0.02† 9.39
†Photons per 100 n capture in K

G.A.Bartholomew, B.B.Kinsey, Can J. Phys. 31, 927 (1953).

K^{42}
19 23

I 2 M
μ −1.137
$\Delta F = \pm 1$, $\Delta m = \pm 1$ transitions studied
$\Delta\nu(K^{42})/\Delta\nu(K^{39}) = 1258.9/461.75$
$\mu(K^{39}) = 0.391$

E.H.Bellamy, K.F.Smith, Phil. Mag. 44, 33(1953).

τ $12.516^h \pm 0.007$ K(pile n) ic

P.R.J.Burch, Nature 172, 361 (1953).

τ $12.44^h \pm 0.08$ K(pile n) chem
γ 20% 1.51 scin, ic
No other γ observed

B.Kahn, W.S.Lyon, Phys. Rev. 91, 1212(1953).

Capture γ's K(n,γ) pair s
0.3† 6.31?
0.1† 7.34
Assignment from agreement with d,p results
†Photons per 100 n captures in K

G.A. Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 927 (1953).

Ca

Capture γ Ca(n,γ) 2 cryst scin
1.93

T.H.Braid, Phys. Rev. 91, 442A(1953).

Ca^{39}
20 19

τ 1.00^s Ca($\leqslant$ 25-Mev γ)

R.G.Summers-Gill, R.N.H.Haslam, L. Katz, Can. J. Phys. 31, 70 (1953).

τ 1.00^s Ca($\leqslant$ 30-Mev γ)
β^+ 6.7 a

R.Braams, C.L.Smith, Phys. Rev. 90, 995 (1953).

Ca^{40}
20 20

Levels Ca(p,p′) E_p=6.92 to 8.15
3.35 3.90 s
3.71 4.49

C.M.Braams, C.K.Bockelman, C.P.Browne, W.W. Buechner, Phys. Rev. 91, 474A (1953); verbal report.

Level Ca(p,p′) E_p = 7.7 a
3.8

J.A.Harvey, Phys. Rev. 88, 162A(1952).

Ca^{41}
20 21

Levels Ca(p,p′) E_d = 14.3
d,p(θ) g.s. $l_n = 3$
(1.95) $l_n = 1$

C.F.Black, Phys. Rev. 90, 381A(1953); verbal report.

Levels Ca(d,p) E_d = 8.13 ppl
d,p(θ)

	l_n	$d\sigma/d\Omega$†
g.s.	3	3.8
1.90	1	23
2.42	1	10
2.9		
3.6		
3.96	2 or 1	6
4.76	2	7.2
5.72	2	7.8

†mb/sterad at maximum of angular distribution

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A, 565 (1953).

$Ca^{41?}$
20 21

Capture γ's Ca(n,γ) scin
6.8
8.2

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Ca^{43}
20 23

I 7/2 I
μ −1.3157

C.D.Jeffries, Phys. Rev. 90, 1130 (1953).

Ca^{45}
20 25

τ 164^d Ca(pile n)

C.F.G.Delaney, J.H.J.Poole, Phys. Rev. 89, 529 (1953).

Ca^{47}
20 27

τ 4.8^d
D 3.4^dSc Ca(th n)
ion chem

L.G.Cook, K.D.Shafer, Phys. Rev. 90, 1121(1953).

Ca^{48}
20 28

$\tau_{\beta\beta}$ $>10^{14y}$ ppl
Assuming decay energy $\geqslant$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Sc^{41}
21 20

τ 0.873^s Ca(30-Mev p) scin

W.M.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952)

Sc^{43}
21 22

τ 3.95^h Ca(7-Mev p) chem

J.E.Duval, M.H.Kurbatov, J. Am. Chem. Soc. 75, 2246 (1953).

Sc^{43} 21 22

τ 3.9^h

$\beta^+(+\epsilon)$ 28% 0.77 s

72% 1.18

γ 0.375 s pe$^-$

Weak 1.15γ probably in Sc^{44}

Ca^{43}(7-Mev p), Ca(20-Mev α) chem

J.R.Haskins, J.E.Duval, L.S.Cheng, J.D.Kurbatov, Phys. Rev. 88, 876(1952).

Sc^{46} 21 25 85^d

β^- 0.357 Sc(pile n) sπ

F-K plot linear to 0.12

Y.Yoshizawa, J. Phys. Soc. Japan 8, 435 (1953).

β^- 0.22% 1.25 F-K plot not linear s

F.H.Schmidt, G.L.Keister, Phys. Rev. 91,483A (1953).

β^- $\leq$0.1% $\leq$1.2 sπ

γ (0.88) $\alpha = 1.9 \times 10^{-4}$

(1.11) $\alpha = 0.88 \times 10^{-4}$

J.A.Whalen, F.T.Porter, C.S.Cook, Phys. Rev. 89, 902A(1953).

γ (0.88) $\tau < 2^{\mu s}$ $\beta\gamma$

(1.11) $\tau < 2^{\mu s}$ $\beta\gamma$

S.Koicki, R.Ballini, R.Chaminade, Compt. rend. 236, 1155(1953).

γ 0.885 Sc(pile n)

1.119 s$\pi\sqrt{2}$ pe$^-$

T.Lindquist, Arkiv Fysik 6, 123(1953).

No delayed $\gamma\gamma$ (τ < 1.5×10^{-9}s)

C.E.Whittle, F.T.Porter, Phys. Rev. 90,498(1953).

Sc^{46} 21 25

Level Sc^{45}(d,p) $E_d = 7.8$ pc

d,p(θ) g.s. ? $l_n = 1$ ($\leq$ 15%), 3 ($\geq$85%)

J.S.King, E.H.Beach, Phys. Rev. 90,381A(1953); verbal report.

Capture γ's $Sc^{45}(n,\gamma)$ scin

0.152 (20^s Sc^{46})

0.220

7 - 9 possible lines

No crossover of 0.152 and 0.220 γ's observed

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ's $Sc^{45}(n,\gamma)$ pair s

2$^+$	6.35	5$^+$	8.18
2.5$^+$	6.84	1$^+$	8.31
0.7$^+$	7.15	2.5$^+$	8.54
1$^+$	7.65	0.3$^+$	8.85

$^+$Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Sc^{47} 21 26

β^- ~66% 0.435 Ti^{49}(10-Mev d)

~34% 0.622 sl

$_{21}Sc^{47}_{26}$

γ 0.185 scin

(0.44β)(γ) No(0.62β)(γ)

L.S.Cheng, M.L.Pool, Phys. Rev. 90,886 (1953).

τ 3.44^d Ca(7-Mev p) chem

J.E.Duval, M.H.Kurbatov, J. Am. Chem. Soc. 75, 2246 (1953).

Sc^{48} 21 27

γ 100† (0.98) scin

100† 1.05

100† (1.33)

From comparison with V^{48} No 2.2γ

M.J.Sterk, A.H.Wapstra, R.E.W.Kropveld, Physica 19, 135 (1953).

γ ~100† 0.99 scin pe$^-$

~100† 1.32

No 2.29 γ (<0.1†)

M.M.Miller, Phys. Rev. 88, 516(1952).

Ti

Relative abundances $TiCl_4$; ms

A	46	47	48	49	50
%	7.87	7.25	73.9	5.56	5.43

H.C.Mattraw, C.F.Pachucki, AECU-1903(1952); NSA 6, 2526(1952).

Capture γ's Ti(n,γ) 2 crystal scin s

37† 0.33

~100† 1.4

†Photons per 100 n captures

J.T.Braid, Phys. Rev. 90,355A(1953); verbal report

Capture γ's Ti(n,γ) scin

1.38

5.0

6.5 - 7.0

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ Ti(n,γ) pair s

1.4$^+$ 4.67

‡Isotopic assignment uncertain

$^+$Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ti^{47} 22 25

I 5/2 $Ti^{47}Cl_4$ I

μ -0.7866

$\nu(Ti^{47})/\nu(Cl^{35})$ = 0.57493 ± 0.00006

C.D.Jeffries, Phys. Rev. 92,1096A(1953).

Levels Ti^{46}(d,p) 82.68% Ti^{46} pc

10†	g.s.	17†	3.09
34†	1.40	50†	3.70
13†	2.39	50†	4.18
32†	2.64		

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Ti^{48}
22 26

Levels* Ti^{47}(d,p) 82.05% Ti^{47} pc
10† g.s. 150† 4.50
10† 1.33 180† ~4.9
<50† 2.31 250† ~5.2
100† 3.31
*Longest range p group observed may go to first excited and not g.s.

G.F.Pieper, Phys. Rev. 88, 1299(1952).

$Ti^{48?}$
22 26

Capture γ's Ti(n,γ) pair s
1.5+ 7.38
0.4+ 8.27
0.1+ 9.39
Assignment assuming n binding = 11.63, 9.39γ to 2.31β decay level
+Photons per 100 n captures in Ti

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ti^{49}
22 27

I 7/2 $Ti^{49}Cl_4$ I
μ -1.102
$\nu(Ti^{49})/\nu(Cl^{35})$ = 0.57508 ± 0.00006

C.D.Jeffries, Phys. Rev. 92,1096A(1953).

Levels Ti^{48}(d,p) 98.90% Ti^{48} pc
10† g.s. 40† 2.41
90† 1.35 120† 3.11
60† 1.70

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Capture γ's Ti(n,γ) pair s
5+ 4.88
3.5+ 4.96
0.4+ 5.65 (Ti^{49}?)
32+ 6.412
4+ 6.53
53+ 6.756 (also Ti^{50}?)
Assignment from agreement with d,p results; see also Ti
†Photons per 100 n captures in Ti 89, 375

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ti^{50}
22 28

Levels Ti^{49}(d,p) 77.27% Ti^{49} pc
10† g.s. 240† 4.88
10† 1.58 190† 5.39
< 10† 3.0 330† 5.99
240† 4.14

G.F.Pieper, Phys. Rev. 88, 1299(1952).

$Ti^{50?}$
22 28

Capture γ's Ti(n,γ) pair s
53+ 6.756 (also Ti^{49})
0.8+ 7.80
0.2+ 9.19
Assignment assuming n binding = 10.8, 9.19γ to 1.58 d,p level
+Photons per 100 n captures in Ti

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ti^{51}
22 29

τ 5.79^m ± 0.03 Ti(pile n)
Counted for 8 half-lives in β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Ti^{51}
22 29

τ 5.9^m
Mass assignment confirmed by Ca^{48}(20-Mev α), Ti^{50}(slow n), Cr^{54}(fast n), V^{51}(fast n)

W.R.Hammond, D.N.Kundu, M.L.Pool, Phys. Rev. 90, 157(1953).

β^- 80% 1.9 V(n) Ti(d) chem; a,s
20% 2.2
γ 0.32 scin
(1.9β) (0.32γ)

L.Koester, H.Maier-Leibnitz, T.Mayer-Kuckuk, K.Schmeiser, G.Schulze-Pillot, Z. Phys. 133, 319(1952).

Levels Ti^{50}(d,p) 84.69% Ti^{50} pc
10† g.s. 8† { 1.15?
3† 0.61 1.6?

G.F.Pieper, Phys. Rev. 88, 1299(1952).

No long lived Ti^{51} activity from Ti(th n),ms
Activity in Ti foil due to Ta^{182}, chem

W.Forsling, A.Ghosh, Arkiv Fysik 4, 331(1951).

V^{46}
23 23

τ 0.40^s Ti(15-Mev p)
β^+ ~6 scin bias

W.M.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952).

V^{48}
23 25

τ 16.4^d
(1.32γ) (0.99γ) (θ) I = 4,2,0

P.Meyer, G.Schlieder, Z. Phys. 135, 119 (1953).

β^+ ~95† 0.69 $Sc^{45}(\alpha,n)$ chem; sπ
~5† ~0.82
γ (0.99) scin
100† (1.32)
2† (2.22)
(0.511γ) (1.32γ,0.99γ,2.2γ)
(1.32γ) (0.99γ) No(0.99γ) (2.2γ) No(1.32γ) (2.2γ)
$\gamma\gamma(\theta)$ indicates I = 4, 2, 0
No ce$^-$ between 0.070 and 0.12

P.L.Roggenkamp, C.H.Pruett, R.G.Wilkinson, Phys. Rev. 88, 1262(1952).

γ ~100† 0.99 scin
~100† 1.32
1.7† 2.29
(0.511γ,1.32γ) (0.99γ)
(0.511γ) (1.32γ,2.2γ)

M.M.Miller, Phys. Rev. 88, 516(1952).

γ 0.98 scin
1.33
2.22 ± 0.10
ϵ/β^+ = 0.46

M.J.Sterk, A.H.Wapstra, R.E.W.Kropveld, Physica 19, 135 (1953).

γ (0.99) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$
(1.32) $\tau <$? x 10^{-9s} $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259 (1953).

V^{50} 23 27

$\tau_{\beta,\epsilon}$ $>10^{12y}$

S.G.Cohen, Bull. Research Council Israel 2, 195 (1952).

I 6 para

J.M.Baker, B.Bleaney, Proc. Phys. Soc. 65A, 952 (1952).

I 6 para

C.Kikuchi, M.H.Sirvetz, V.W.Cohen, Phys. Rev. 88, 142(1952); 92, 109(1953).

V^{51} 23 28

I 7/2 para

C.Kikuchi, M.H.Sirvetz, V.W.Cohen, Phys. Rev. 88, 142(1952); 92, 109(1953).

Levels V(p,p′) $E_p = 8$ s

0.33	2.43	3.83
0.48	2.65	3.96
1.16	3.11	4.90
1.84	3.41	4.97
2.22	3.58	

No level at 0.267 by (p,p)

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

V^{51} ? 23 28

Capture γ's V(n,γ) pair s

0.3+	7.67
1.3+	7.83
0.5+	7.96

E_γ greater than V^{51} n binding
γ intensity implies $\sigma_a(V^{50}) = 40 - 400$
+Photons per 100 n captures in V

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

V^{52} 23 29 16^h

τ_1 16^h V(pile n)
γ scin

0.059	0.85	1.76
0.096	1.00	2.33
0.539	1.40	3.2
0.74		

T.Wiedling, Phys. Rev. 91, 767 (1953).

V^{52} 23 29

τ_2 $3.76^m \pm 0.02$ V^{51}(pile n)
Counted for 5 half-lives in β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Levels V^{51}(d,p) $E_d = 7.8$ pc
d,p(θ) g.s. $l_n = 1 (\geq 75\%)$, $3 (\leq 25\%)$
(0.79) $l_n = 1$
(1.6) $l_n = 1$

J.S.King, W.C.Parkinson, Phys. Rev. 89,1080; 90,318A(1953).

Capture γ's V(n,γ) pair s

2+	3.39	10+	5.511
3+	3.59	9+	5.744
3+	3.73	3+	5.88
4+	4.15	25+	6.508
3+	4.45	0.7+	6.62
2+	4.85	14+	6.868
2+	4.98	18.5+	7.154
6+	5.21	11+	7.305

+Photons per 100 n captures in V

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Capture γ's V(n,γ) scin
5.3 6.8
5.7 7.4

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Cr

Levels Cr(p,p′) $E_p = 8$ s

0.48	3.20	3.80
0.81	3.46	3.99
2.69	3.51	4.07
2.79	3.65	4.78

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Capture γ's Cr(n,γ) pair s

0.5+	3.72	3.0+	6.644
0.6+	4.83	0.6+	6.872
1+	5.26	2.6+	7.097
2+	5.61	0.2+	7.21
1+	6.00	0.2+	7.54
0.7+	6.12	0.2+	7.67
0.9+	6.26	7+	8.499
0.3+	6.358		

‡Isotopic assignment uncertain
+Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Capture γ's Cr(n,γ) scin
0.880 8.0 – 8.5
5 – 6 8.5 – 9.0
Spectrum very complex at high energies

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Cr^{49} 24 25

τ 41.7^m Ti(40-Mev α)
β^+ 15† 0.73 chem sl
35† 1.39
50† 1.54
γ 0.153 $\alpha_K = 0.02$ M1 ce; pe⁻
0.609 $\alpha_K = < 4 \times 10^{-4}$ pe⁻
No 0.782 γ

B.Crasemann, H.T.Easterday, Phys. Rev. 90,1124 (1953).

Cr^{51} 24 27

γ 0.330 pc
No lower energy γ

A.L.Cockroft, quoted by S.C.Curran, Physica 18, 1161(1953).

γ 21% (0.32) $\alpha_K = 0.0015$ M1 pc, scin
No 0.267 γ

D.Maeder, P.Preiswerk, A.Steinemann, Helv. Phys. Acta 25, 461(1952).

Cr^{52} 24 28

Level Cr(n,n′γ) $E_n = 3.7$ scin
γ 1.43
Level also by n,n′
Assignment from agreement with Mn^{52} decay

M.A.Rothman, D.W.Kent, C.E.Mandeville, J.Franklin Inst. 256,278(1953); Phys. Rev. 92,1097A(1953).

Cr^{52} 24 28

Levels Cr(p,p') $E_p = 8$ s
1.45
2.43
2.99
Assignment from agreement with Mn^{52} decay

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Cr^{53} 24 29

I 3/2 para
$|\mu|$ 0.58

K.D.Bowers, Proc. Phys. Soc. 65A, 860(1952).

μ -0.47362 Na_2CrO_4 I
$\nu(Cr^{53})/\nu(D)$ = 0.36820 ± 0.00003 90% Cr^{53}

C.B.Jeffries, P.B.Sogo, Phys. Rev. 91,1286(1953).

μ -0.47351 I
$\nu(Cr^{53})/\nu(N^{14})$=0.78226±0.00005 Na_2CrO_4

F.Alder, K.Halbach, Helv. Phys. Acta 26,426(1953).

Level Cr(d,p) E_d = 14.3
d,p(θ) g.s. $l_n = 1$

C.F.Black, Phys. Rev. 90, 381A(1953).

Levels Cr^{52}(d,p) E_d = 10.2 ppl

0.54	3.20
0.97	3.65
1.29	4.10
2.66	

C.E.McFarland, M.M.Bretscher, F.B.Shull, Phys. Rev. 89, 892A(1953).

Capture γ's Cr(n,γ) pair s
3† 7.364
8† 7.929
Assignment from agreement with d,p results; see also Cr
†Photons per 100 n captures in Cr

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

$Cr^{53?}$ 24 29

23 α tracks from Fe(th n) $E_\alpha \sim 5$ ppl

J.P.Lonchamp, J. phys. radium 13, 333(1952).

No reaction Fe(th n,α) $\sigma < 10^{-5}$ ppl

H.Faraggi, J. phys. radium 14, 160(1953).

Cr^{54} 24 30

$\tau_{\beta\beta}$ $> 6 \times 10^{15y}$ ppl
Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Capture γ's Cr(n,γ) pair s
19† 8.881
7† 9.716
Assignment from masses and Mn^{54} 0.835γ; see also Cr
†Photons per 100 n captures in Cr

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

$Cr^{54?}$ 24 30

Capture γ Cr(n,γ) 2 cryst scin
0.83 see also Cr

T.H.Braid, Phys. Rev. 91, 442A (1953).

Cr^{55} 24 31

τ 3.52^m Cr(n,γ) Mn(n,p) chem
β^- 2.85 a
No γ (< 10%)

A.Flammersfeld, W.Herr, Z. Naturforsch. 7a, 649 (1952).

Mn^{50} 25 25

τ 0.28^s Cr(17-Mev p)
β^+ ~6.3 scin bias

W.M.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952).

Mn^{55} 25 30

q ~0.5 Mic

A.Javan, G.Silvey, C.H.Townes, A.V.Grosse, Phys. Rev. 91, 222A(1953).

Levels Mn^{55}(p,p') E_p = 8 s

0.13	2.27	3.05
1.00	2.42	3.21
1.30	2.59	3.31
1.56	2.77	3.42
1.91	2.85	3.64

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Mn^{56} 25 31

τ $2.576^h \pm 0.002$ Mn(th n)
Counted for 11 half-lives 4π counter

R.M.Bartholomew, R.C.Hawkins, W.F.Merritt, L.Yaffe, Can. J. Chem 31, 204(1953).

τ $2.581^h \pm 0.003$ Mn(pile n)
Counted 2 samples each for 10 half-lives with automatic recording β electroscope

R.M.Bartholomew, F.Brown, W.D.Howell, W.R.J.Shorey, L.Yaffe , Can. J. Phys. 31, 714 (1953).

τ $2.574^h \pm 0.003$ Mn(pile n)
Counted for 4 half-lives with β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

γ (0.85) $\tau < 2 \times 10^{-9} s$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259 (1953).

γ 100† 1.81 $\alpha_{pair} = 5.6 \times 10^{-4}$ E1 sl
100† 2.13 $\alpha_{pair} = 4.6 \times 10^{-4}$ E2? pe⁻

H.Slätis, K.Siegbahn, Arkiv Fysik 4, 485(1952).

Capture γ's Mn^{55}(n,γ) scin
0.090 5.0
0.190 7.2
No crossover of 0.090 and 0.190 γ's observed

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ's Mn^{55}(n,γ) pair s

1†	3.82	0.3†	5.63
1†	4.10	1†	5.77
2†	4.24	0.5†	5.91

Mn^{56} 25 31

2^+	4.55	1^+	6.11
2^+	4.72	0.6^+	6.43
2^+	4.81	2.5^+	6.779
6^+	5.04	6.5^+	7.048
3^+	5.21	4^+	7.15
4^+	5.53	12^+	7.261

$^+$Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Fe γ's Fe(n,n'γ) E_n = 14 scin n'γ
0.85
1.29
1.42
2.1

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 91, 441A (1953); verbal report.

γ's Fe(n,n'γ) E_n = 14 scin n'γ
3.3
4.4
5.8
7.1
8.75
Spectrum continuous below 3 Mev

V.E.Scherrer, R.Theus, W.R.Faust, Phys. Rev. 89, 1268 (1953).

Capture γ's Fe(n,γ)
0.425
8.5
Isotopic assignment uncertain

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916 (1952).

Capture γ's Fe(n,γ) pair s

2.0^+	3.43
0.5^+	3.86
2^+	4.21
1^+	4.44
1^+	4.81
0.4^+	6.369

Isotopic assignment uncertain
$^+$Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Fe^{55} 26 29 E_{dis} 0.20 scin
from continuous γ endpoint

P.Bolgiano, L.Madansky, F.Rasetti, Phys. Rev. 89, 679 (1953).

E_{dis} 0.22 scin
from continuous γ endpoint

A.Michalowicz, J. phys. radium 14, 214 (1953).

(K x ray)(K x ray) in ~0.04% of disintegrations from double ionization of K shell pc

G.Charpak, Compt. rend. 237, 243 (1953).

No e^- ($<6 \times 10^{-5}$%) between 0.030 and 0.20
Mn^{55}(10-Mev d,2n) chem

F.T.Porter, M.P.Hotz, Phys. Rev. 89, 938 (1953).

Fe^{55} 26 29 Capture γ's Fe(n,γ) pair s

0.8^+	8.345
0.5^+	8.872
2.7^+	9.298 (also Fe^{58} ?)

Assignment from agreement with d,p and p,n results; see also Fe
$^+$Photons per 100 n captures in Fe

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Fe^{56} 26 30 γ Fe(n,n'γ) E_n = 3.7 scin
0.88

M.A.Rothman, D.W.Kent, C.E.Mandeville, J.Franklin Inst. 256, 278 (1953). Phys. Rev. 92, 1097A (1953).

γ Fe(n,n'γ) E_n = 2.4 scin
(0.85)

M.J.Poole, Phil. Mag. 43, 1060 (1952).

γ Fe(n,n'γ) E_n = 1.23 scin
(0.85)

B.Rose, J.M.Freeman, Proc. Phys. Soc. 66A, 120 (1953).

γ's Fe(n,n'γ) E_n = 14 scin
0.85
1.25

L.C.Thompson, Phys. Rev. 89, 905A (1953).

γ's Fe(n,n'γ) E_n = 2.5 scin
0.85
1.25
1.42 (Fe^{57}?)

R.B.Day, Phys. Rev. 89, 908A (1953).

Fe^{57} 26 31 $|\mu|$ <0.05 para

R.S.Trenam, Proc. Phys. Soc. 66A, 414 (1953).

Levels Fe(d,p) E_d = 14.3
d,p(θ)

g.s.	l_n = 1
~1.4	l_n = 1
~2.6	l_n = 1

C.F.Black, Phys. Rev. 90, 381A (1953).

Capture γ's Fe(n,γ) pair s

0.5^+	4.968
5.2^+	5.914
5.6^+	6.015
3.5^+	7.285
36^+	7.639

Assignment from agreement with d,p results; see also Fe
†Photons per 100 n captures in Fe

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Capture γ's Fe(n,γ)
6.0
7.4
Assignment from intensities
No line at 1.4 observed

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916 (1952).

Fe^{58} 26 32

$\tau_{\beta\beta}$ $>3 \times 10^{14y}$ ppl
Assuming decay energy $\gtrsim 2$ Mev

J.M.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Capture γ's Fe(n,γ) pair s
2.7† 9.298 (also Fe^{55} ?)
0.1† 10.16
Assignment from masses and Co^{58} decay;
*see also Fe
†Photons per 100 n captures in Fe

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375(1953).

Fe^{59} 26 33

β^-	46%	0.271	F-K plot linear		sl
	54%	0.462	F-K plot linear		
	0.3%	1.560	F-K plot not α or D_2		
γ	2.8%	0.191	$\alpha = 7 \times 10^{-3}$	M1	
	57%	1.098	$\alpha = 1.8 \times 10^{-4}$	M1	
	43%	1.289	$\alpha = 1.4 \times 10^{-4}$	E2	

(0.19γ) (1.1γ) Fe^{58}(pile n,γ); sl ce$^-$ pe$^-$
$\gamma\gamma(\theta)$ agrees with I = 3/2, 5/2, 7/2 scin

F.R.Metzger, Phys. Rev. 88, 1360(1952).

$\gamma\gamma$ (θ) scin
Agrees with I = 3/2, 5/2, 7/2
Excludes I = 5/2, 3/2, 7/2

D.Schiff, F.H.Metzger, Phys. Rev. 90, 849 (1953).

γ 58† 1.10 sπ cpt
42† 1.28
No other γ (0.5 to 2.1) < 10%

B.S.Dzhelepov, N.N.Zhukovskii, Y.V.Khol'nov, Doklady Akad. Nauk SSSR 86, 497(1952).

γ (1.10) $\alpha = 1.8 \times 10^{-4}$ s ce$^-$
(1.30) $\alpha = 1.1 \times 10^{-4}$

G.Hinman, D.Brower, R.Leamer, Phys. Rev. 90, 370A(1953).

Co

Neutron resonance E_n = 1 ev to 5 kev
123 ev $\sigma_0\Gamma^2 = 2.1 \times 10^5$

A.W.Merrison, E.R.Wiblin, Proc. Roy. Soc. 215A, 278(1952).

Co^{54} 27 27

τ ~0.18^s Fe(17-Mev p)
β^+ ~7.4 scin bias

W.M.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952).

Co^{56} 27 29

β^+ ~3† 0.995 Mn^{55}(20-Mev α) chem; s
β^+ ~8† 1.53

L.S.Cheng, J.L.Dick, J.D.Kurbatov, Phys. Rev. 88, 887(1952).

Co^{57} 27 30

I 7/2 para
μ 4.6

J.M.Baker, B.Bleaney, K.D.Bowers, P.F.D.Shaw, R.S.Trenam, Proc. Phys. Soc. 66A, 305(1953).

Co^{57} 27 30

β^+ 0.320 Mn^{55}(20-Mev α) chem; s

		α_K	K/L	
γ	<0.018			s ce^-_L
	0.119	~0.7	~6.3	M2,E3 ce$^-$
	0.133	~0.7	~5.2	E3 pe$^-$

L.S.Cheng, J.L.Dick, J.D.Kurbatov, Phys. Rev. 88, 887(1952).

Co^{58} 27 31 72^d

|μ| 3.5* $\gamma(\theta,T)$
0.805γ is not dipole $\gamma(\theta,T)$
*Based on I = 2

J.M.Daniels, M.A.Grace, H.Halban, N.Kurti, F.N.H. Robinson, Phil. Mag. 43, 1297(1952).

τ_2 72^d d 9.2^{h}Co chem

D.C.Hoffman, D.S.Martin Jr., J. Phys. Chem. 56, 1097(1952).

β^+ 0.472 Mn^{55}(20-Mev α) chem; s
γ (0.805) $\alpha_K = 2.9 \times 10^{-4}$ E2 ce$^-$,pe$^-$

L.S.Cheng, J.L.Dick, J.D.Kurbatov, Phys. Rev. 88, 887(1952).

γ (0.805) Electric multipole
Polarization from low temp. aligned nuclei

G.R.Bishop, J.M.Daniels, G.Goldschmidt, H.Halban, N.Kurti, F.N.H.Robinson, Phys. Rev. 88, 1432 (1952).

Co^{59} 27 32

Level Co(n,n'γ) E_n = 2.7
γ 1.1 scin

V.E.Scherrer, W.L.Smith, B.A.Allison, W.R.Faust, Phys. Rev. 91, 768 (1953).

Co^{60} 27 33 10.7^m

τ_1 10.47^m ± 0.02 Co(pile n)
Counted 6 samples each for 7 half-lives

R.M.Bartholomew, F.Brown, W.D.Howell, W.R.J.Shorey L.Yaffe, Can. J. Phys. 31, 714 (1953).

γ 0.059 α_K = 35 pc, scin

J.H.Kahn, ORNL-1089(1951).

5.2^y

|μ| 3.5 $\gamma(\theta,T)$
Value of 3.0 (Phys. Rev. 85, 688.) in error

B.Bleaney et al., quoted by J.M.Daniels et al., Phil. Mag. 43, 1297(1952).

τ_2 4.95^y ± 0.04 Co(pile n)
Counted for 8 months with β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

τ_2 5.21^y ± 0.04
Counted for 3 years with ic

J.Kastner, G.N.Whyte, Phys. Rev. 91, 332 (1953).

β^- 0.316 Co(pile n) sπ

Y.Yoshizawa, J. Phys. Soc. Japan, 8, 435(1953).

Co^{60} 27 33 5.2y

γ 1.1728 K/LM~10 sπ ce_K^-
1.3325 K/LM~10

Energy calibration from authors' new absolute measurement of 1.12 and 1.41 γ's of Bi^{214}

G.Lindström, A. Hedgran, D.E.Alburger, Phys. Rev. 89, 1303(1953).

γ (1.17) $\tau < 2 \times 10^{-9}s$ βγ
(1.33) $\tau < 2 \times 10^{-9}s$ βγ

T.C.Engelder, Phys. Rev. 90, 259 (1953).

γ (1.17) Electric multipole
(1.33) Electric multipole

Polarization from low temp. aligned nuclei

G.R.Bishop, J.M.Daniels, G.Goldschmidt, H.Halban, N.Kurti, F.N.H.Robinson, Phys. Rev. 88, 1432 (1952).

$(1.17\gamma)/(1.33\gamma) = 0.98 \pm 0.04$ sπ Cpt

B.S.Dzhelepov et al, Doklady Akad. Nauk USSR 77, 233(1951); NSA 5, 6510(1951).

$\gamma\gamma(\theta)$, γγ polarization-direction scin
I = 4+, 2+, 0+

R.M.Kloepper, E.S.Lennox, M.L.Wiedenbeck, Phys. Rev. 88, 695(1952).

$\gamma\gamma(\theta)$, γγ polarization-direction
I = 4+, 2+, 0+

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

$\gamma\gamma(\theta)$ I=4,2,0 b= 0.167

J.S.Lawson, Jr., H.Frauenfelder, W.K.Jentschke, Phys. Rev. 91, 484A; 91, 649 (1953).

$\gamma\gamma(\theta)$ I=4,2,0 b= 0.166

S.Chatterjee, A.K.Saha, Z.Phys. 135, 141 (1953).

$\gamma\gamma(\theta)$ depends on chemical state

E.D.Klema, F.K.McGowan, Phys. Rev. 91, 616(1953).

Co^{60} 27 33

Capture γ's Co(n,γ) scin

0.220	5.8
1.1	7.0
1.5	

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ's Co(n,γ) 2 cryst scin s

100†	0.52
19†	1.30
20†	2.00
	2.39?
19†	3.58

W.A.Reardon, R.W.Krone, R.Stump, Phys. Rev. 91, 334; 91, 442A (1953).

Capture γ's Co^{59}(n,γ) pair s

1+	3.36	5.6+	5.966
0.7+	3.69	0.5+	6.11
1+	4.03	0.7+	6.250

Co^{60} 27 33

0.8+	4.18	5+	6.474
1+	4.37	6+	6.690
0.6+	4.59	7+	6.867
2.5+	4.903	2.5+	6.97
2+	5.18	1.3+	7.04
0.7+	5.35	4.0+	7.201
6.3+	5.646	3.0+	7.486
1.7+	5.73		

+Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Ni

Relative abundances $Ni(CO)_4$; ms

A	58	60	61	62	64
%	68.0	26.3	1.13	3.66	1.01

H.C.Mattraw, C.F.Pachucki, AECU-1903(1952); NSA 6, 2526(1952).

Capture γ's Ni(n,γ) pair s

3+	5.82	9+	6.84
0.3+	5.99	0.5+	7.05
1.0+	6.10	0.5+	7.22
0.6+	6.34	2.8+	8.12
2.0+	6.58		

Isotopic assignment uncertain
+Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ni^{59} 28 31

Levels Ni^{58}(d,p) E_d = 10.2 ppl

0.42	5.20
3.08	5.66
4.57	

C.E.McFarland, M.M.Bretscher, F.B.Shull, Phys. Rev. 89, 892A(1953).

Capture γ's Ni(n,γ) pair s

1+	5.31	
0.4+	5.70	
14+	8.532	(also Ni^{61} ?)
35+	8.997	

Assignment from agreement with d,p results; see also Ni
†Photons per 100 n captures in Ni

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ni^{61} 28 33

Capture γ's Ni(n,γ) pair s

4+	7.528	
6.5+	7.817	
14+	8.532	(also Ni^{59} ?)

Assignment from agreement with d,p results and Cu^{61} decay; see also Ni
+Photons per 100 n captures in Ni

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

Ni^{63} 28 35

F-K plot concave toward energy axis below 30 kev although S^{35} and Pm^{147} plots linear to 10 kev

J.P.Mize, D.J.Zaffarano, Phys. Rev. 91, 210A(1953).

Ni^{64}
28 36

$\tau_{\beta\beta}$ $> 3 \times 10^{15y}$ ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Cu

γ's Cu(n,n'γ) $E_n = 2.7$
0.88 scin
~1.5

V.E.Scherrer, W.L.Smith, B.A.Allison, W.R.Faust, Phys. Rev. 91, 768 (1953).

γ's Cu(n,n'γ) $E_n = 14$ scin n'γ
1.1
1.55
2.14

R.E.Garrett, F.L.Hereford, B.W.Sloope, Phys. Rev. 91, 441A (1953); verbal report.

Capture γ's Cu(n,γ) scin
0.150
6.5 - 7
7 - 8

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ's Cu(n,γ) pair s

$0.7^{\dagger}$	5.07	$0.2^{\dagger}$	5.75
$0.6^{\dagger}$	5.18	$1^{\dagger}$	6.05
$1^{\dagger}$	5.31	$1^{\dagger}$	6.41
$1^{\dagger}$	5.43	$1^{\dagger}$	7.16
$0.5^{\dagger}$	5.64		

Isotopic assignment uncertain
†Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Cu^{58}
29 29

τ 3.04^s Ni(15-Mev p)

W.M.Martin, S.W.Breckon, Can. J. Phys. 30, 643 (1952).

Cu^{61}
29 32

γ (0.65) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259 (1953).

Cu^{62}
29 33

τ 9.80^m

J.Goldenberg, M.D.Sousa-Santos, E.Silva, Ciencia cultura 3, 307(1951); Chem. Abst. 46-10926(1952).

Cu^{63}
29 34

Q -0.16 para

B. Bleaney, K.D.Bowers, R.S.Trenam, Proc. Phys. Soc. 66A, 410 (1953).

Cu^{64}
29 35

$\beta^+\gamma$? No $\beta^-\gamma$

S.Meric, Istanbul Univ. Fen Fakült. Mecmuasi 16A, 51(1951).

Capture γ's Cu(n,γ) pair s
$3^{\dagger}$ 6.69
$2^{\dagger}$ 7.01

Cu^{64}
29 35

$5.5^{\dagger}$ 7.296
$20^{\dagger}$ 7.914

Assignment from agreement with d,p results; see also Cu
†Photons per 100 n captures in Cu 9, 386

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Cu^{65}
29 36

Q -0.15 para

B. Bleaney, K.D.Bowers, R.S.Trenam, Proc. Phys. Soc. 66A, 410 (1953).

Cu^{66}
29 37

τ $5.07^m \pm 0.02$ Cu(pile n)
Counted for 9 half-lives β electroscope

R.M.Bartholomew, F.Brown, W.D.Howell, W.R.J.Shorey, L.Yaffe, Can. J. Phys. 31, 714 (1953).

τ 5.10^m Cu(slow n)
Counted with β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

γ (1.04) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259 (1953).

Capture γ Cu(n,γ) pair s
$9^{\dagger}$ 7.634 ?
Assignment from agreement with unpublished d,p results, but disagrees with Zn^{66} (γ,n); see also Cu
†Photons per 100 n captures in Cu

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 89, 386 (1953).

Cu^{67}
29 38

τ		61^h	Ni(40-Mev α)		
β^-	45%	0.395	Zn(195-Mev d)	chem; sl	
	35%	0.484			
	20%	0.577			
γ		0.092	$\alpha \approx 0.5$		E2
		0.182	$\alpha = 0.012$		M1

H.T.Easterday, Phys. Rev. 91, 653 (1953).

β^-		0.37	Zn(27-Mev d)	a/$\beta\gamma$
		0.45		a/$\beta\gamma$
	~55%	0.55		a
γ	st	0.094		scin
	st	0.19		
	w	0.30		
	w	0.39		

(0.37β) (0.19γ) (0.45β) (0.09γ)

R.H.Nussbaum, A.H.Wapstra, N.F.Verster, Physica, 19, 131 (1953).

Cu^{68}
29 39

τ	32^s	Zn($\leq$ 15-Mev n)	chem; a
β^-	~3.0	Ga($\leq$ 15-Mev n)	
γ weak			

A.Flammersfeld, Z.Naturf. 8a, 274 (1953).

Zn

Capture γ's Zn(n,γ) scin
1.0
7.5

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ's Zn(n,γ) pair s

1.2^+	4.14	0.3^+	6.26
1.6^+	4.84	1^+	6.49
0.7^+	5.23	0.5^+	6.65
2.5^+	5.48	2.7^+	6.94
1^+	5.77	2.0^+	7.19
0.8^+	6.03		

Isotopic assignment uncertain
+Photons per 100 n captures

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953).

$_{30}Zn^{62}_{32}$

τ 8.4^h Ni(13-Mev He^3)

D.N.Kundu, T.W.Donaven, M.L.Pool, J.K.Long, Phys. Rev. 89, 1201(1953); Physica 18, 1304 (1952).

$_{30}Zn^{64}_{34}$

$\tau_{\epsilon\epsilon}$ $>3\times10^{15^y}$ pc

A.Berthelot, R.Chaminade, C.Levi, L.Papineau, Compt. rend. 236, 1769 (1953).

$_{30}Zn^{65}_{35}$

β^+ 0.327 sl
γ (1.11) $\alpha = 1.8\times10^{-4}$
$\gamma/\beta^+ = 26\pm6$ Na^{22} comparison and ce$^-/\beta^+$
No 0.20γ ($< 3\times10^{-4}$) sl pe$^-$

M.Sakai, P.Hubert, Compt. rend. 236,1249 (1953).

β^+ (0.327) F-K plot linear to 0.05
γ (1.11) $\alpha = 2.6\times10^{-4}$
$\epsilon_k/\beta^+ = 28\pm3$

J.F.Perkins, S.K.Haynes, Phys. Rev. 92, 1096A(1953).

γ (1.11) $\alpha = 2.5\times10^{-4}$ sl ce$^-$, Cpt

E.F.Sturcken, A.H.Weber, Phys. Rev. 91,484A (1953).

$\gamma/\beta^+ = 31 \pm 5$ Na^{22} comparison
No 0.20γ ($< 0.1\%$) scin

N.Perrin, J. Phys. radium 14, 273 (1953).

$\epsilon_K/\beta^+ = 33\pm3$ pc

P.Avignon, Compt. rend. 237, 157 (1953).

Capture γ Zn(n,γ) pair s
10^+ 7.876
Assignment from agreement with d,p results; see also Zn
†Photons per 100 n captures in Zn

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375(1953).

$_{30}Zn^{68}_{38}$

Capture γ's Zn(n,γ) pair s

0.6^+	8.31
0.2^+	8.58
0.2^+	8.98
1^+	9.12
0.07^+	9.51

Assigned here since E_γ > n binding in other Zn's; see also Zn
+Photons per 100 n captures in Zn

B.B.Kinsey, G.A.Bartholomew, Phys. Rev. 89, 375 (1953)

$_{30}Zn^{69}_{39}$ 13.8^h

γ 0.435 $\alpha = 0.06$ sl ce$^-$, scin

R.B.Duffield, L.M.Langer, Phys. Rev. 89, 854 (1953).

52^m

β^- 100% 0.897 sl

R.B.Duffield, L.M.Langer, Phys. Rev. 89, 854 (1953).

$_{30}Zn^{70}_{40}$

$\tau_{\beta\beta}$ $>10^{15^y}$
Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Ga

Neutron resonances E_n = 5 ev to 5 kev
94 ev
290 ev

A.W.Merrison, E.R.Wiblin, Proc. Roy. Soc. 215A, 278(1952).

$_{31}Ga^{64}_{33}$

τ 2.5^m Zn^{64}(8.1-Mev p)
β^+ ~5 chem scin
γ 0.97
2.2?
3.8
E_{dis} = 7.2±0.5 from (p,n) threshold

B.L.Cohen, Phys. Rev. 91, 74 (1953).

τ 2.6^m Zn^{64}(9.5-Mev p)
β^+ Zn(19-Mev d) Cu(40-Mev α) chem

B.Crasemann, Phys. Rev. 90, 995 (1953).

$_{31}Ga^{65}_{34}$

τ 15^m Cu(21-Mev He^3)
β^+ 2.1

M.L.Pool, Physica 18, 1304(1952).

β^+ 2.2 Zn(6-Mev d) chem; a

A.H.W.Aten, Jr., H.de Wijs, M.Boelhouwer, Physica 18, 1032(1952).

β^+ 90% 2.1 Zn(19-Mev d) Cu(40-Mev α)
10% 2.52 chem; sl

B.Crasemann, Phys. Rev. 90, 995 (1953).

$_{31}Ga^{67}_{36}$

γ (0.092) $\tau \sim 1^{\mu s}$
(0.18γ) (0.30γ)

S.C.Fultz, H.J.Nash, R.L.Woodward, Phys. Rev. 88, 170A(1952).

γ (0.092) $\tau \sim 350^{\mu s}$ scin
(0.18γ) (0.30γ) Cu(21-Mev He^3)

M.L.Pool, Physica 18, 1304(1952).

Ga^{67} 31 36

ϵ				Zn(p)	ion chem	
γ			α_K	K/L		
	2.7%	0.090	0.074			M1
	63.9%	0.092	0.63	7.0		E2
	29.6%	0.182	0.011	12.6		M1
	1.0%	0.206	0.029	~14		
	20.2%	0.296	0.0029	7.6		M1
	4.9%	0.388	0.0019			M1
	0.4%	0.496				
	0.2%	0.790		sl ce^- pe^-, scin		
	0.4%	0.880				

$(0.206\gamma)(0.090\gamma, 0.182\gamma)$ (all γ's)(γ)
$(0.496\gamma)(0.296\gamma, 0.388\gamma)$
$(0.090\gamma, 0.296\gamma)(0.092\gamma)$ delay of $8.5^{\mu s}$
No other delay ($<5\times10^{-7s}$)
Decay scheme, spins proposed

B.H.Ketelle, A.R.Brosi, F.M.Porter, Phys. Rev. 90, 567 (1953).

Ga^{72} 31 41

γ 64† 2.491 ± 0.002 $s\pi\sqrt{2}$ pe^-
100† 2.508 ± 0.002

A.Hedgran, D.Lind, Arkiv Fysik 5, 177(1952).

Ge

Relative abundances GeF$_4$; ms

A	70	72	73	74	76
	20.52	27.43	7.76	36.54	7.76

J.H.Reynolds, Phys. Rev. 90, 1047 (1953).

Ge^{71} 32 39

E_{dis} 0.23 scin
from continuous γ endpoint

B.L.Saraf, J. Varma, C.E.Mandeville, Phys. Rev. 91, 1216 (1953); Phys. Rev. 92, 848A (1953); J.Franklin Inst. 256, 279 (1953).

Ge^{75} 32 43 48^s

τ_1 48^s $As^{75}(n,p)$ $Ge^{74}(n,\gamma)$
γ 0.175 scin

A.B.Smith, R.S.Caird, A.C.G.Mitchell, Phys. Rev. 88, 150(1952).

82^m

β^-	15%	0.614	$Ge^{74}(n,\gamma)$; sl
	85%	1.137	
γ		0.265	sl pe^-,scin
		0.408	sl ce^-,scin
		0.572	sl Cpt,scin

No $(1.137\beta^-)(\gamma)$

A.B.Smith, R.S.Caird, A.C.G.Mitchell, Phys. Rev. 88, 150(1952).

No delayed ce^- ($\tau < 1^{\mu s}$)

R.Ballini, Ann. Phys. 8, 441 (1953).

Ge^{76} 32 44

$\tau_{\beta\beta}$ $>2\times10^{16y}$ ppl
Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Ge^{77}? 32 45

γ 2.3 Ge(pile n)
2.7
[Due to 14^h Ga^{72} impurity?]

B.L.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 91, 1216 (1953).

Ge^{78} 32 46

τ 86^m U^{235}(pile n,f) chem; pc

N. Sugarman, Phys. Rev. 89, 570(1953).

As^{70} 33 37

τ	52^m	Ge(26-Mev d) chem
β^+	2.7	a
γ	1.04*	scin
	1.7 ?*	
	2.0*	

$K/\beta^+ < 0.2$ $\gamma/\beta^+ \sim 2$

B.Verkerk, A.H.W.Aten, Jr., Physica 18, 974(1952); *A.H.Wapstra, N.F.Verster, ibid.

As^{71} 33 38

τ		60^h	Ge(25-Mev d) ms
β^+	w	~0.30?	chem s
		0.82	
γ		0.0233	s ce^-
		0.175	

H.Atterling, S.Thulin, Nature 171, 927 (1953).

τ	60^h	Ge(14-Mev d)
β^+	0.80	chem $s\pi\sqrt{2}$
γ	0.175 K/LM = 8.3	

$ce_K^-/\beta^+ = 0.14$

P.H.Stoker, O.P.Hok, Physica 19, 279 (1953).

As^{72} 33 39

γ 0.697 Ge(14-Mev d)
$ce_K^-/\beta^+ = 0.0090$ chem $s\pi\sqrt{2}$ ce^-

P.H.Stoker, O.P.Hok, Physica 19, 279 (1953).

As^{73} 33 40

γ 0.0130 Ge(14-Mev d)
0.053 K/LM=5.2 chem; ce^-

P.H.Stoker, O.P.Hok, Physica 19, 279 (1953).

γ 0.0135 α= large $\tau = 4.6^{\mu s}$
0.054 $900^{\mu s} < \tau < 10^s$
0.0135 γ follows 0.054 γ scin

J.P.Welker, A.W.Schardt, J.J.Howland, Jr., G.Friedlander, Phys. Rev. 91, 484A (1953).

As^{75} 33 42

μ 1.43524 I
$\nu(As^{75})/\nu(D) = 1.11569 \pm 0.00005$
Na_2HAsO_4, D_2O

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

No isomeric state observed after 5 min. separation of As from Se^{75}

E.N.Jensen, L.J.Laslett, D.S.Martin, Jr., F.J. Hughes, W.W.Pratt, Phys. Rev. 90, 557 (1953).

As^{76} 33 43

β^-	3%	0.48	As(pile n); $s\pi\sqrt{2}$
	12%	1.76	
	33%	2.40	
	52%	2.98	$\Delta I = 2$, yes shape
γ		0.558	$\alpha_K = 0.002$ ce^-

E.P.Tomlinson, S.L.Ridgway, Phys. Rev. 88, 170A(1952), verbal report.

As^{76} 33 43

γ 0.56 (E)2 $\gamma\gamma(\theta)$
0.65 (E)2 (>85%) $\gamma\gamma(\theta)$
$(0.65\gamma)(0.56\gamma)(\theta)$ I = 2, 2, 0 scin

F.R.Metzger, W.B.Todd, J.Franklin Inst. 256, 277 (1953).

γ 0.56 (E)2 $\gamma\gamma(\theta)$
0.65 (M)1 (20-66%) $\gamma\gamma(\theta)$
1.21
2.1
$(0.65\gamma)(0.56\gamma)(\theta)$ I = 2,2,0 As(slow n) scin

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

$(\sim 2\beta)(\sim 0.6\gamma)(\theta)$ b = 0.076 sl

H.Rose, Phil. Mag. 44, 739 (1953).

As^{77} 33 44

τ 38.0^h U^{235}(pile n,f) chem; pc

N.Sugarman, Phys. Rev. 89, 570 (1953).

τ 38.7^h U(n,f) Ge(n,$\gamma\beta$) chem
14† {0.023, 0.028} scin
20† 0.086
10† 0.160
150† 0.246
50† 0.524
†Photons per 10^4 disintegrations

M.E.Bunker, R.J.Prestwood, J.W.Starner, Phys. Rev. 91, 1021 (1953).

τ 39^h Ge(pile n,$\gamma\beta$) chem
γ 0.033? scin
140† 0.25
50† 0.53
$(\sim 0.44\beta)(0.25\gamma)$ $\alpha\beta\gamma$
†Photons per 10^4 disintegrations

S.A.Reynolds, G.W.Leddicotte, H.A.Mahlman, Phys. Rev. 91, 333 (1953).

γ 0.032 d 12^hGe scin
25† 0.087
8† 0.160
165† 0.247
3† 0.270
50† 0.520
$(0.27\gamma)(0.25\gamma)$ No$(0.52\gamma)(\gamma)$
$(\sim 0.44\beta)(0.25\gamma)$ No$(0.69\beta)(\gamma)$
†Photons per 10^4 disintegrations

B.L.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 91, 1216 (1953); Phys. Rev. 92, 848A (1953); J. Franklin Inst. 256, 279 (1953).

γ 30† 0.088 d 12^hGe
~20† 0.155 scin
230† 0.243
70† 0.528
$(0.155\gamma)(0.088\gamma)$
No$(0.52\gamma)(\gamma)$ No$(0.24\gamma)(0.088\gamma, 0.155\gamma)$
†Photons per 10^4 disintegrations

F.Rasetti, É.C.Booth, Phys. Rev. 91, 1192 (1953).

As^{78} 33 45

τ 91.0^m d $86^m Ge^{78}$ U^{235}(pile n,fβ^-)
No ~40^m activity observed chem; pc

N.Sugarman, Phys. Rev. 89, 570 (1953).

τ 88^m U(n,f) chem
β^- 4.1 α
No 40^m As activity found but did find Sb(?) with $\tau \sim 30^m$

J.G.Cuninghame, Phil. Mag. 44, 900 (1953).

As^{79} 33 46

τ 9.0^m U(n,f) chem
β^- 2.3 p 3.9^mSe α

J.G.Cuninghame, Phil. Mag. 44, 900 (1953).

Se^{75} 34 41

ϵ (no β's) Se(pile n)
γ 0.5% 0.067 sl ce⁻ pe⁻
14% 0.077
6.5% 0.098 $\alpha_K \sim 8$ K/L=11
~3% 0.124 $\alpha_K \sim 0.3$
24% 0.138 $\alpha_K = 0.12$
0.04% 0.203
71% 0.269 $\alpha_K = 0.09$
~5% 0.281
0.03% 0.308
14% 0.405 $\alpha_K = 0.0015$
No 0.0247 γ No delayed $\gamma\gamma(0.3^{\mu s}-10^{\mu s})$
$(<0.15\gamma)(\gamma)$ Decay scheme proposed

E.N.Jensen, L.J.Laslett, D.S.Martin, Jr., F.J. Hughes, W.W.Pratt, Phys. Rev. 90, 557 (1953).

Se^{77} 34 43 17^s

γ 0.16 Se(fast n); sl ce⁻

J.Orring, Arkiv Fysik 4, 469 (1952).

γ 0.13 Se(pile n); pc, scin

J.H.Kahn, ORNL-1089 (1951).

stable

μ 0.53262 H_2Se Mic
$\nu(Se^{77})/\nu(D) = 1.24211 \pm 0.00010$

H.E.Walchli, Phys. Rev. 90, 331 (1953).

Se^{79} 34 45 3.9^m

τ_1 3.88^m d 9^mAs chem

J.G.Cuninghame, Phil. Mag. 44, 900 (1953).

Se^{82} 34 48

τ $>10^{17}y$ Se chem
No 36^h Br detected

H.D.Sharma, Curr. Sci. 22, 45 (1953).

Br^{77} 35 42

γ 0.023? 0.524 scin
0.086 0.58
0.160 0.76
0.246 0.82
0.300 1.00
No 0.641γ

M.E.Bunker, R.J.Prestwood, J.W.Starner, Phys. Rev. 91, 1021 (1953).

Br^{78} 35 43 6.3^m

Br K_α x rays cryst
Suggest known 0.046 and 0.108 γ's are from isomeric state in Br^{78}

P.Marmier, P.Preiswerk, quoted by P.Stähelin, P.Preiswerk, Nuovo Cim. 10, 1219 (1953).

Br^{79} 35 44

$\mu(Br^{81})/\mu(Br^{79}) = 1.07794$ M

q 0.335

$q(Br^{79})/q(Br^{81}) = 1.19707$

J.G.King, V.Jaccarino, Phys. Rev. 91, 209A(1953).

$q(Br^{79})/q(Br^{81}) = 1.1967$ quad res

E.Manring, C.Brown, D.Williams, Phys. Rev. 90,348A (1953).

$q(Br^{79})/q(Br^{81}) = 1.1970$ C_2H_5Br quad res

S.Kojima, K.Tsukada, S.Ogawa, A.Shimauchi, J. Chem. Phys. 21, 1415 (1953).

Br^{80} 35 45 18^m

No γ ($\gamma/\beta^+ \leqslant 1.25$)

J.Laberrique-Frolow, R. Bernas, H.Langevin, Compt. rend. 236, 1246 (1953).

γ 0.62 Br(pile n) scin

$\gamma/\beta^- = 0.09$ $(\beta)(0.62\gamma)$

No$(0.511\gamma)(0.62\gamma)$ No$(x)(0.62\gamma)$

G.S.Goldhaber, M.McKeown, Phys. Rev. 92, 356(1953).

Br^{81} 35 46

$\mu(Br^{81})/\mu(Br^{79}) = 1.07794$ M

q 0.280

$q(Br^{79})/q(Br^{81}) = 1.19707$

J.G.King, V.Jaccarino, Phys. Rev. 91,209A(1953).

Br^{82} 35 47

γ	368†	0.535	s
		0.602	
	353†	0.750	
	100†	1.02	
	85†	1.29	
	40†	1.45	

B.Dzhelepov, A.Silant'ev, Doklady Akad. Nauk SSSR. 85, 533(1952); NSA 6-6197(1952).

βe^- delay < several μs

R.Ballini, Ann. Phys. 8, 441 (1953).

Br^{84} 35 49

γ	st	0.890	scin
	w	1.89	

L.M.Langer, R.B.Duffield, Quoted by C.M.Huddleston, A.C.G.Mitchell, Phys. Rev. 88, 1350(1952).

Br^{87} 35 52

β^-	70%	2.6	U(n,f)	$a\beta\gamma$
	30%	8.0	chem	a
γ	80†	2-4		
	20†	5.4		

n emission (2%), presumably following 2.6β

$(2.6\beta)(\gamma)$ $\gamma\gamma$

A.F.Stehney, N.Sugarman, Phys. Rev. 89,194(1953).

Kr^{83} 36 47

τ 1.86^h

L.J.de Vries, F.T.M.Veringa, J.Clay, Koninkl. Ned. Akad. Wetenschap., Proc. 55B, 303(1952).

Kr^{85} 36 49 4.4^h

β^-	85%	0.83	Kr(n,γ) U(n,f)	ms; sl
γ	85%	0.1495	$\alpha_K = 0.041$	M1 ce$^-$
γ IT	15%	0.3050		K/LM = 7

$[\beta]$ $[e_K^-(0.15\gamma)]$

I.Bergström, Arkiv Fysik 5, 191(1952).

Kr^{85} 36 49 10^y

τ_2 10.27^y U(n,f) chem ms

From decrease in abundance in seven years

R.K.Wanless, H.G.Thode, Can. J. Phys. 31,517 (1953).

β^- 0.666 $\Delta I = 2$, yes shape sl

Kr(n,γ) U(n,f) ms

I.Bergström, Arkiv Fysik 5, 191(1952).

Kr^{88} 36 52

β^-	68%	0.52	U(n,f)	ms; sl
	12%	0.9 ?		
	20%	2.7		$a\beta\gamma$; sl
γ		0.028		K/LM = 8

$[e_K^-(0.028\gamma)]$ $[\sim 0.5\beta]$; $e^-/\beta = 0.085$

S.Thulin, Arkiv Fysik 4, 363(1952).

Rb^{82} 37 45 6.3^h

β^+	24†	0.175	Br(<20-Mev α);		sl
	76†	0.775			
γ		0.188	0.464	0.818	ce$^-$, pe$^-$
		0.248	0.550	1.020	
		0.322	0.610	1.314	
		0.389	0.690	1.464	
		0.423	0.768 v st		

C.M.Huddleston, A.C.G.Mitchell, Phys. Rev. 88, 1350(1952).

Rb^{82} ? 37 45

τ	76^s	d 25.5^dSr	a
β^+	4.2		

β^+ observed in 25.5^dSr but assigned here

P.Kruger, N.Sugarman, Phys. Rev. 90, 158(1953).

Rb^{84} 37 47 23^m

τ_1		21^m	Rb(fast n)	ion chem
γ	25†	0.239		scin
	10†	0.463		

$(0.23\gamma)(0.23\gamma)$ No $(0.23\gamma)(0.46\gamma)$ scin

No x rays observed pc

R.S.Caird, A.C.G.Mitchell, Phys. Rev. 89, 573 (1953).

40^d

β^+	~3†	0.37 ?	Br(<20-Mev α); $s\pi$, sl
	58†	0.82	
	39†	1.629	$\Delta I = 2$, yes shape
γ		0.890	scin, $s\pi$ ce$^-$

No other γ No β^- (vw if present)

$(\sim 0.8\beta^+)(\gamma)$ No $(1.63\beta^+)(\gamma)$

C.M.Huddleston, A.C.G.Mitchell, Phys. Rev. 88, 1350(1952).

Rb^{86} 37 49 1.0^m

τ_1	1.02^m	Rb^{85}(pile n)	
γ	0.56		scin

No x rays (< 3%) consistent with E3, E4 pc

R.B.Schwartz, M.L.Perlman, W.Bernstein, Phys. Rev. 91, 883 (1953).

19^d

ϵ_K <0.1% Rb(pile n) chem; pc

R.B.Schwartz, M.L.Perlman, W.Bernstein, Phys. Rev. 91, 883 (1953).

$\beta\gamma$ polarization-direction

1.08γ no parity change

D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 90,370A(1953); verbal report.

Rb^{87} 37 50

τ 5.90×10^{10y} RbI(Tl) scin
β^- 0.275 F-K plot not linear
No ce^- or γ

G.M.Lewis. Phil. Mag. 43, 1070(1952).

τ $\geq 4.8 \times 10^{10y}$
No (β)(e^-) 4π counter

I.Bähnisch, E.Huster, W.Walcher, Naturwiss. 39, 379(1952).

Rb^{88} 37 51

τ 17.7^m d 2.7^hKr; sl
β^- 13% 2.5 $\Delta I = 2$, yes shape
9% 3.6
78% 5.3

S.Thulin, Arkiv Fysik 4, 363(1952).

Sr^{82}? 38 44

τ 25.5^d Ag(450-Mev p) chem
Parent 76^sRb; not p 6.3^hRb (< 1%) chem

P.Kruger, N.Sugarman, Phys. Rev. 90, 158(1953).

Sr^{87} 38 49 2.7^h

τ_1 2.88^h Sr(d) d 80^hY chem
γ 0.3882 K/LM = 5.8 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

stable

μ -1.0895 $SrBr_2$ I
$\nu(Sr^{86})/\nu(D)$ = 0.28322 ± 0.00003 60% Sr^{87}

C.D.Jeffries, P.B.Sogo, Phys. Rev. 91,1286(1953).

Sr^{88} 38 50

$\tau_{\beta\beta}$ $> 3 \times 10^{16y}$ ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Sr^{89} 38 51

Levels Sr(d,p) E_d = 10.4 s
1.07
2.07
2.54

C.E.McFarland, F.B.Shull, Phys. Rev. 89, 489(1953).

Levels Sr(d,p) E_d = 8.01 ppl
1.07 4.73
2.09 5.46
2.66

J.R.Holt, T.N.Marsham, Proc. Phys. Soc. 66A,565 (1953).

τ 9.67^h U(n,f) chem sl
β^- 7% 0.61
33% 1.09
29% 1.36
4% 2.03
27% 2.67 ΔI=2, yes shape
γ 20.5† 0.552 $s\pi$ pe^- scin
5.2† 0.645
9.2† 0.748
1.1† 0.93
10.4† 1.025
1.8† 1.413
(γ)(0.65γ) (γ)(0.93γ) (γ)(1.41γ)

D.P.Ames, M.E.Bunker, L.M.Langer, B.M.Sorenson, Phys. Rev. 89, 903A; 91,68 (1953).

Y^{82} 39 43

τ $\sim 70^m$ Y(130-Mev p) p 26^dSr chem

A.A.Caretto, Jr., E.O.Wiig, J. Am. Chem. Soc. 74, 5235(1952).

Y^{83} 39 44

τ 3.5^h Y(130-Mev p) p 38^hSr chem

A.A.Caretto, Jr., E.O.Wiig, J. Am. Chem. Soc. 74, 5235(1952).

Y^{85} 39 46

τ 5^h Y(130-Mev p) p 65^dSr chem

A.A.Caretto, Jr., E.O.Wiig, J. Am. Chem. Soc. 74, 5235(1952).

Y^{87} 39 48 14^h

γ 0.3813 K/LM = 5.4 s
No ce^- in region above 1 Mev

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

80^h

γ 0.4834 K/LM ~ 7 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

Y^{88} 39 49

γ (0.91) $\alpha_K = 3.4 \times 10^{-4}$ E1
(1.85) $\alpha_K = 1.7 \times 10^{-4}$ E2,M1

F.R.Metzger, H.C.Amacher, Phys. Rev. 88, 147 (1952).

(0.908γ)(1.85γ)(θ) I=3,2,0
γ (0.908) (E)1 (M)2<0.001%

J.Varma, B.L.Saraf, W.B.Todd, Jr., Phys. Rev. 91, 484A (1953).

(0.908γ)(1.85γ)(θ) I=3,2,0
γ (0.908) (E)1 (M)2 0.002-0.015%

R.M.Steffen, Phys. Rev. 90, 321 (1953).

Y^{90} 39 51

γ 0.05% ~1.5
From deviation from theoretical shape of inner bremsstrahlung absorbed in Pb

B.Makiej, Acta Phys. Polon. 12, 32(1953).

Y^{91} 39 52 51^m

τ_1 50.3^m d 9.7^h Sr chem
γ 0.551 α_K=0.046 $s\pi$ ce^-
K/LM=6.0 M4
No β^- (< 1.5% of IT)

D.P.Ames, M.E.Bunker, L.M.Langer, B.M.Sorenson, Phys. Rev. 89, 903A; 91 68 (1953).

γ 0.5512 K/LM = 6.0 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

57^d

τ_2 61^d
β^- 1.54 ΔI = 2, yes shape scin
1.16γ observed with $\tau \sim 160^d$ No(1.16γ)(β)

F.I.Boley, D.S.Dunavan, Phys. Rev. 90, 158(1953).

Continuous γ spectrum scin
$\gamma(E_\gamma > 0.09)/\beta^-$ = 0.0019

P.Bolgiano, L.Madansky, F.Rasetti, Phys. Rev. 89, 679(1953).

Y^{92} 39 53

Mass assignment of 3.5^h activity confirmed from Zr(7.8-Mev d,α) yields

G.L.Schott, W.W.Meinke, Phys. Rev. 89, 1156(1953).

Y^{94} 39 55

Mass assignment of 16.5^m activity confirmed from Zr(7.8-Mev d,α) yields

G.L.Schott, W.W.Meinke, Phys. Rev. 89, 1156(1953).

Zr^{89} 40 49 4.5^m

τ_1		4.25^m	Zr($\leq$24-Mev γ)	

L.Katz, R.G.Baker, R.Montalbetti, Can. J. Phys. 31, 250(1953).

τ_1		4.40^m	Zr^{90} ($\leq$22-Mev γ)	
β^+	1.5%	~0.85		$a\beta\gamma$
	~0.4%	2.43		scin
γ	100†	0.588	K/LM = 5.4	α = 0.08
	8†	1.53		

(0.85β) (1.53γ)

β^+/0.59γ = 0.019

F.J.Shore, W.L.Bendel, H.N.Brown, R.A.Becker, Phys. Rev. 91, 1203 (1953).

80^h

τ_2	78^h	Zr($\leq$24-Mev γ)	

L.Katz, R.G.Baker, R.Montalbetti, Can. J. Phys. 31, 250(1953).

τ_2	79^h	Zr^{90} ($\leq$22-Mev γ)	
β^+	0.90		sπ
γ	0.913	K/LM = 7	ce$^-$

No γ(E_γ= 0.95-2.0) < 1%

β^+/0.91γ = 0.2

F.J.Shore, W.L.Bendel, H.N.Brown, R.A.Becker, Phys. Rev. 91, 1203 (1953).

Zr^{95} 40 55

τ		65^d	Zr^{94}(pile n,γ)	
			U(pile n,f)	
β^-	~49%	~0.360		s$\pi\sqrt{2}$
	~49%	~0.400		
	~ 2%	0.910		
γ		0.235	K/L = 4.5	sπ ce$^-$
		0.725	K/L = 5	
		0.758		

J.M.Cork, J.M.LeBlanc, D.W.Martin, W.H.Nestor, M.K.Brice, Phys. Rev. 90, 579 (1953).

β^-	99%	0.370	Zr(pile n)	ion chem
	1%	0.84		s
γ		0.721	α=0.0024	s pe$^-$, ce$^-$

No 0.92γ

H.Slätis, L.Zappa, Arkiv Fysik 6, 81(1953).

β^-	54%	0.364		s
	43%	0.396		
γ		0.722	α_K = 0.0014	s ce$^-$
		0.754	α_K = 0.0011	

$\beta\gamma$ (θ) b = 0.00 ± 0.03

P.S.Mittelman, Phys. Rev. 91,484A(1953); verbal report.

γ	0.73	U(n,f)	chem; scin

(β) (0.73γ) indicates γ/β ~ 1

C.E.Mandeville, E.Shapiro, R.I.Mendenhall, E.R. Zucker, G.L.Conklin, Phys. Rev. 89, 559(1953).

Zr^{96} 40 56

$\tau_{\beta\beta}$	6×10^{16} y	89.5% Zr^{96}	scin

β or γ of 3.8±0.5

J.A.McCarthy, Phys. Rev. 90, 853 (1953).

Nb^{90} 41 49

τ	14.7^h	d 5.7^hMo	chem
β^+	1.2		Al a

Absorption due to x rays, β^+ or both

R.M.Diamond, Phys. Rev. 89, 1149(1953).

Nb^{92} 41 51

No β^- (< 0.05%)

γ	0.930	$\alpha = 8\times10^{-4}$	s

P.Stähelin, P.Preiswerk, Nuovo Cim. 10, 1219(1953). Helv. Phys. Acta 24, 300 (1951).

No β^-

			Nb^{93}(20-Mev p)	chem; a,s
γ	~100†	0.933		scin
	1†	1.84		

H.K.Ticho, D.Green, J.R.Richardson, Phys. Rev. 86, 422(1952); 87, 195A(1952); priv. comm.

Nb^{94} 41 53 6.6^m

γ	(0.042)	α_K>100	Nb(pile n); pc

J.H.Kahn, ORNL-1089(1951).

long

τ_2		2.2×10^{4} y*	Nb(pile n)	chem
β^-		0.50		a
γ	92†	0.70		scin
	92†	0.87		
	8†	1.57		

*Based on $\sigma_a(Nb^{93})$ = 1.1

D.L.Douglas, A.C.Mewherter, R.P.Schuman, Phys. Rev. 92, 369 (1953).

Nb^{95} 41 54 90^h

τ_1	84^h	d 65^dZr	chem
γ	0.231		s ce$^-$

H.Slätis, L.Zappa, Arkiv Fysik 6, 81(1953).

γ	0.235	K/L = 4.5	sπ ce$^-$

J.M.Cork, J.M.LeBlanc, D.W.Martin, W.H.Nestor M.K.Brice, Phys. Rev. 90, 579 (1953).

γ	(0.22)	K/LM = 2.5	sl ce$^-$

V.S.Shpinel, Zhur. Ekspt'l i Teoret. Fiz. 22, 255(1952); Phys. Abst. 55-8254(1952).

35^d

τ_2	35.0^d	d 65^dZr;	chem
β^-	0.165		s$\pi\sqrt{2}$
γ	0.753		sπ ce$^-$
	0.768	K/L = 7.6	

Evidence for low energy γ a

J.M.Cork, J.M.LeBlanc, D.W.Martin, W.H.Nestor, M.K.Brice, Phys. Rev. 90, 579 (1953).

β^-	0.159	d 65^dZr	chem
γ	0.745	α = 0.0024	s; ce$^-$

H.Slätis, L.Zappa, Arkiv Fysik 6, 81(1953).

β^-	0.171		sl
γ	0.771	α = 0.0018	K/LM = 2.4

E.F.Strucken, A.H.Weber, Phys. Rev. 91,484A (1953); verbal report.

Nb^{95} 41 54 35^d

γ 0.774 K/LM = 6.6 s ce$^-$

R.E.Maerker, R.D.Birkhoff, Phys. Rev. 89, 1159 (1953).

γ 0.76 d 65^dZr chem; scin

(β)(0.76γ) indicates $\gamma/\beta \sim 1$

C.E.Mandeville, E.Shapiro, R.I.Mendenhall, E.R. Zucker, G.L.Conklin, Phys. Rev. 89, 559(1953).

γ 0.764 s ce$^-$

P.S.Mittelman, Phys. Rev. 91,484A(1953).

Nb^{97} 41 56

γ (0.665) $\tau > 1.5\times10^{-12s}$

From attempt to detect nuclear resonance scattering from Mo^{97}

F.R.Metzger, W.B.Todd, Phys. Rev. 91, 1286(1953).

Mo

Neutron resonances (ev) E_n = 1 ev to 10 kev

46.3 $\sigma_o\Gamma^2 = 400$

75

140

~440

E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1952).

Mo^{90} 42 48

τ 5.7^h Nb^{93}(55-Mev p) chem

β^+ ~1.4?* Al a

γ ~0.12 Pb a

~0.25

1.1

*Absorption due to x rays, β^+ or both

R.M.Diamond, Phys. Rev. 89, 1149(1953).

Mo^{91} 42 49 75^s

τ_1 65.5^s Mo($\leqslant$24-Mev γ)

σ (65.5^s)/σ (15.5^m) = 0.2 for E_γ = 16-20 indicating 65.5^s state has larger spin

L.Katz, R.G.Baker, R.Montalbetti, Can. J. Phys. 31, 250(1953).

No 65.5^s activity from Mo (14.4-Mev n,2n); weak activity from Mo (18-Mev n,2n)

J.E.Brolley, Jr., Phys. Rev. 89, 877(1953); 88, 618(1952).

16^m

τ_2 15.5^m Mo($\leqslant$24-Mev γ)

β^+ 3.3 a

65.5^s level 0.15$\pm$0.05 Mev above 15.5^m g.s. from Mo(γ,n) thresholds

L.Katz, R.G.Baker, R.Montalbetti, Can. J. Phys. 31, 250(1953).

Mo^{93} 42 51 6.7^h

τ_1 6.95^h Nb(p,n) chem, rel σ

γ ~ 60$^+$ 0.290 scin

~100$^+$ 0.690

~100$^+$ 1.464

G.E.Boyd, R.A.Charpie, Phys. Rev. 88, 681(1952).

Mo^{93} 42 51 6.7^h

γ	α_K*	K/L	$s\pi$ ce$^-$
0.262	0.53	3.09	E4
0.684	1.5×10^{-3}	8	M1
1.479	2.4×10^{-4}		E2,M1

Mo x rays crit a, cryst

*Based on α (0.262γ) = 0.7

C.W.Forsthoff, R.H.Goeckermann, R.A. Naumann, Phys. Rev. 90, 1004 (1953).

Mass assignment of 6.7^h activity confirmed with ms Nb(6.7-Mev d) chem

γ 0.27 scin

0.70

1.5

R.Bernas, J.Beydon, Compt. rend. 236, 194(1953).

Mass assignment of 6.7^h activity confirmed with ms Nb(25-Mev d)

γ 0.264 K/LM=2.8 L/M~3 $s\pi\sqrt{2}$ ce$^-$

0.685 pe$^-$

1.479 pe$^-$

D.E.Alburger, S.Thulin, Phys. Rev. 89, 1146(1953).

Mo^{100} 42 58

$\tau_{\beta\beta}$ $\geqslant 10^{15y}$ ppl

Assuming decay energy $\geqslant$2 Mev

Definite evidence of activity

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Tc^{93} 43 50 44^m

τ_1 43.5^m Mo^{92}(9.5-Mev p) chem

γ 0.390 α_K = 0.31 K/LM = 5.8 M4 $s\pi\sqrt{2}$ ce$^-$, pe$^-$

Assignment from Nb^{93}(39-Mev α), Mo(~0 to 20-Mev d); formerly assigned to Tc^{92}

H.T.Easterday, H.A.Medicus, Phys. Rev. 89, 752 (1953).

Tc^{96} 43 53 52^m

τ_1 52^m Nb^{93}(13.5-Mev α) $s\pi\sqrt{2}$ ce$^-$

β^+ ~0.01%

γ IT 0.034 K/L = 1.2

Assignment from Mo^{96} (9.5-Mev p), Mo(4-Mev p); formerly assigned to Tc^{94}

H.T.Easterday, H.A.Medicus, Phys. Rev. 89, 752 (1953).

Tc^{99} 43 56 5.9^h

τ (metal) 6.04^h ic

τ dependent on chemical state

K.T.Bainbridge, M.Goldhaber, E.Wilson, Phys. Rev 90, 430 (1953).

Ru^{99} 44 55

I 5/2 para

$\mu(Ru^{101})/\mu(Ru^{99})$ = 1.09

J.H.E.Griffiths, J.Owen, Proc. Phys. Soc. 65A, 951(1952).

I $\geqslant$5/2 or $\leqslant$9/2 S

μ is negative

K.Murakawa, J.Phys. Soc., Japan, 8, 535 (1953).

$Ru^{101}_{44\ 57}$ I 5/2 para
$\mu(Ru^{101})/\mu(Ru^{99}) = 1.09$

J.H.E.Griffiths, J.Owen, Proc. Phys. Soc. 65A, 951(1952).

I $\geqslant$5/2 or $\leqslant$9/2 S
μ is negative

K.Murakawa, J. Phys. Soc., Japan, 8, 535 (1953).

$Ru^{103}_{44\ 59}$ γ (0.499) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

Rh Neutron resonance (ev) cryst s
1.260±0.004 σ_o = 5000±200
Γ =0.156±0.005

V.L.Sailor, Phys. Rev. 91, 53; 90, 363A(1953).

$Rh^{97}_{45\ 52}$? τ 31^m Ru(28-Mev d) chem
β^+

A.H.W.Aten, Jr., H.Cerfontain, W.Dzcubas, T.Hamerling, Physica 18, 972(1952).

$Rh^{98}_{45\ 53}$? τ 9^m Ru(28-Mev d) chem
β^+ s

A.H.W.Aten, Jr., H.Cerfontain, W.Dzcubas, T.Hamerling, Physica 18, 972(1952).

$Rh^{99}_{45\ 54}$ γ 0.286 Ru(p); sπ ce$^-$

S.C.Fultz, R.J.Nash, R.L.Woodward, M.L.Pool, Phys. Rev. 88, 170A(1952).

$Rh^{101}_{45\ 56}$ γ 0.144 Ru(p); sπ ce$^-$
0.286
No β^+

S.C.Fultz, R.J.Nash, R.L.Woodward, M.L.Pool, Phys. Rev. 88, 170A(1952).

$Rh^{104}_{45\ 59}$ 4.3^m γ 14† 0.0511 K/L >5 sπ ce$^-$
170† 0.0772 K/L ~0.6 scin
(0.051γ) (χ) $\chi\chi$ Rh(pile n)
†Relative intensity ce$^-$

W.C.Jordon, J.M.Cork, S.B.Burson, Phys. Rev. 90, 862(1953).

γ 0.052 α~25 pc, scin

J.H.Kahn, ORNL-1089(1951).

44^s γ 0.55 Rh(pile n);scin
W ~1.2
No (0.55γ) (χ) No (0.55γ) (γ)

W.C.Jordan, J.M.Cork, S.B.Burson, Phys. Rev.90, 862 (1953).

$Rh^{104}_{45\ 59}$ Capture γ's Rh(n,γ) scin
0.080
0.160

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

$Rh^{106}_{45\ 61}$ γ scin

100 †	0.51
53 †	0.62
2 †	0.87
7 †	1.04
1 †	1.55

(0.62γ) (0.51γ) (θ) and polarization-direction I = 0+, 2+, 0+
$\gamma\gamma(\theta)$ coefficients 12% lower than theory

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

Pd Relative abundances ms

A	102	104	105
%	0.96	10.97	22.23
A	106	108	110
%	27.33	26.71	11.81

J.R.Sites, G.Consolazio, R.Baldock, Phys. Rev. 92, 1096A (1953).

$Pd^{105}_{46\ 59}$ I 5/2 S

J.Blaise, H.Chantrel, J. phys. radium 14, 135 (1953).

I 5/2 ? s
μ -0.57

A.Steudel, Z.Phys. 132, 429(1952).

$Pd^{109}_{46\ 63}$? 4.8^m τ_1 5^m Pd(pile n)
γ 0.17 α~1 - scin

J.H.Kahn, ORNL-1089(1951).

$Pd^{109}_{46\ 63}$ 13^h τ_2 13.6^h Pd(pile n);chem
Counted for 15 half-lives G-M counter

W.W.Meinke, Phys. Rev. 90, 410 (1953).

$Pd^{112}_{46\ 66}$ γ 0.018 U(28-Mev d)scin
chem

R.Nussbaum, R.H.Wapstra, A.H.Verster, N.F.Cerfontain, H.Cerfontain, Physica 19,385 (1953).

Ag γ's Ag(n,n'γ) E_n= 2.7 scin
1.1
1.5

V.E.Scherrer, W.L.Smith, B.A.Allison, W.R.Faust, Phys. Rev. 91, 768 (1953).

Neutron resonance (ev) cryst s
5.24

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90,363A(1953).

Neutron resonances (ev) E_n = 12 ev to 5 kev
5.15 ± 0.03 52
15.9 $\sigma_o\Gamma^2$= 23 66
29.6 125
40

A.W.Merrison, E.R.Wiblin, Proc. Roy. Soc. 215A, 278(1952).

Ag

Neutron resonances (ev) E_n = 15 to 100 ev

16.5	40	52	71
30.7	43	56	88

J.S.Levin, W.Y.Kato, N.G.Sjostrand, D.J.Hughes, Phys. Rev. 90,363A(1953).

Ag^{104} 47 57

τ 27^m d 59^mCd
β^+ 2.70 sπ
γ 0.555

Number of weaker γ's tentatively assigned to Ag^{104}

F.A.Johnson, Proc. Roy. Soc. Canada 46, 135A (1952).

Ag^{106} 47 59 8.6^d

No β^+ (<1% of ϵ) scin

W.L.Bendel, F.J.Shore, H.N.Brown, R.A.Becker, Phys. Rev. 90, 88 (1953).

24.5^m

τ_2 24.0^m Ag(22-Mevγ)
β^+ 17% 1.45 s$\pi\sqrt{2}$
83% 1.96
β^-(?) <1% 0.36
γ 17% 0.512 $\alpha_K \sim 3x10^{-3}$ scin, ce$^-$
ϵ_K/(0.512γ+annhil γ's) = 0.28
High energy photons probably bremsstrahlung

W.L.Bendel, F.J.Shore, H.N.Brown, R.A.Becker, Phys. Rev. 90, 888 (1953).

Ag^{107} 47 60 Stable

$\mu(Ag^{107})/\mu(Ag^{109})$ = 0.86627 M

G.Wessel, H.Lew, Phys. Rev. 91,476A(1953).

Ag^{109} 47 62 39^s

γ (0.087) $\alpha_K \sim 9$ d 13^hPd scin

R.Nussbaum, R.H.Wapstra, A.H.Verster, N.F.Cerfontain, H.Cerfontain, Physica 19,385 (1953).

stable

$\mu(Ag^{107})/\mu(Ag^{109})$ = 0.86627 M

G.Wessel, H.Lew, Phys. Rev. 91,476A(1953).

Ag^{110} 47 63 270^d

(0.53β) (0.66γ,0.89γ,0.94γ)
No(0.53β) (1.52γ,1.39γ)
(0.66γ) (0.89, 0.94γ,1.39γ)
(0.89γ) (0.94γ,1.39γ)
(1.52γ) (0.66γ,0.76γ) No(1.52γ) (0.89γ)
Results in agreement with Siegbahn decay scheme

S.A.E.Johansson, S.Almquist, Arkiv Fysik 5, 427 (1952).

Ag^{110} ? 47 63

Capture γ Ag(n,γ) scin
0.187

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Ag^{111} 47 64

$\bar{E}_\beta$ = 0.376 ±0.014 ic

J.M.Brabant, L.W.Cochran, R.S.Caswell, Phys. Rev. 91,210A(1953).

Ag^{112} 47 65

β^-	15%	~1	U(28-Mev d) a
	20%	2.7	chem $\alpha\beta\gamma$
	40%	3.5	
	25%	4.1	
γ		0.62	scin

No (4.1β) (γ)

R.Nussbaum, R.H.Wapstra, A.H.Verster, N.F.Cerfontain, H.Cerfontain, Physica 19,385 (1953).

Cd

Neutron resonance (ev)
0.180 σ_0 = 7800 Γ = 0.113

B.N.Brockhouse, Can. J. Phys. 31, 432 (1953).

Neutron resonances (ev) E_n = 1 to 4000 ev

	18.0		
st	27.2	Cd^{111}	$\sigma_0\Gamma^2$ = 35
	66.6	Cd^{112}?	
st	88.2	Cd^{110}?	
	122	Cd^{116}?	
	163		
	234		
	400		
	840		

R.R.Palmer, L.M.Bollinger, Phys. Rev. 91,450A (1953); verbal report.

Cd^{104} 48 56

τ 59^m Ag(50-Mev p) chem
β^+ 0.93 sπ
γ 0.0666
0.0835
w 0.1498

F.A.Johnson, Proc. Roy. Soc. Canada 46, 135A (1952).

Cd^{105} 48 57

τ 55^m Ag(35-Mev p) chem
β^+ 1.68 sπ
γ 0.0254 (K x ray?)
2.1

F.A.Johnson, Proc. Roy. Soc. Canada, 46, 135A (1952).

Cd^{111} 48 63

|Q| (0.247 level)~0.5 single In cryst $\gamma\gamma(\theta)$

H.Albers-Schönberg, K.Alder, O.Braun, E.Herr, T.B.Novey, Phys. Rev. 91, 1287 (1953).

Levels Cd(n,n')49^mCd E_n = 0.1 to 1.4
0.72
0.95 ?
1.15
Absolute σ consistent with I = 11/2 for 49^mCd from statistical model

A.E.Francis, J.J.McCue, C.Goodman, Phys. Rev. 89, 1232(1953).

Cd^{114} 48 66

Capture γ's Cd(n,γ) sπ ce$^-$
0.097
0.562

C.T.Hibdon, C.O.Muehlhause, Phys. Rev. 88, 943 (1952); 87, 222A(1952).

$Cd^{114}_{48\ 66}$

Capture γ's Cd(n,γ) sl pe$^-$

89^+	0.555	11^+	0.80
25^+	0.646	20^+	1.30

$^+$Photons per 100 n captures

H.T.Motz, Phys. Rev. 90,355A(1953); verbal report.

Capture γ's Cd(n,γ) scin

0.558
8.5

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

Capture γ's Cd(n,γ) 2 cryst scin s

33†	0.88
13†	1.33
38†	1.61
28†	2.44
34†	3.61
	4.67
	5.17

W.A.Reardon, R.W.Krone, R. Stump, Phys. Rev. 91, 442A; 334 (1953).

Capture γ's Cd(n,γ) pair s

0.36^+	6.82	0.12^+	7.84
0.21^+	7.67	0.23^+	8.48
0.16^+	7.73	0.14^+	9.05

$^+$Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Phys. Rev. 90, 355A(1953).

$Cd^{116}_{48\ 68}$

$\tau_{\beta\beta}$ $>8\times10^{15y}$ ppl
Assuming decay energy ≥ 2 Mev

J.M.Fremlin, M.C.Walters, Proc Phys. Soc. 65A, 911(1952).

$Cd^{117}_{48\ 69}$ 2.8^h

τ_1 2.9^h Cd(d,p) chem
γ 1.2 a

A.H.W.Aten, Jr., M.Boelhouwer, Physica 18, 651 (1952).

τ_1 3.0^h Cd(n,γ) Cd(d,p) U(n,f)
β^- weak if present

C.D.Coryell, P.Lévêque, H.G.Richter, Phys. Rev. 89, 903A(1953).

$\sim 50^m$

τ_2 $\sim 50^m$ Cd(n,γ) Cd(d,p) U(n,f)
β^- and γ p $\sim 2^h$In ?

C.D.Coryell, P.Lévêque, H.G.Richter, Phys. Rev. 89, 903A(1953).

$Cd^{118}_{48\ 70}$

τ $\sim 30^m$ U(n,f)
β^- a
Not p 4.5^mIn

C.D.Coryell, P.Lévêque, H.G.Richter, Phys. Rev. 89, 903A(1953).

In

Neutron resonance (ev)
1.458 σ_0=27,000 Γ=0.114
σ_{so}=1,600 Γ_n/Γ = 0.045

L.B.Borst, Phys. Rev. 90, 859 (1953).

$In^{110}_{49\ 61}$ 4.9^h

τ_1 4.9^h Ag(20-Mev α)
γ IT 195* 0.121 K/LM=4.5 chem; sl ce$^-$
100* 0.657
42* 0.884
27* 0.937

* Relative intensity of ce$^-$

E.Bleuler, J.W.Blue, S.A.Chowdary, A.C.Johnson, D.J.Tendam, Phys. Rev. 90, 464 (1953).

65^m

β+ 2.25 Ag(20-Mev α) sl
γ 0.656 chem sl ce$^-$
(2.25β) (γ) No 2.9β+(<3%) a/$\beta\gamma$

E.Bleuler, J.W.Blue, S.A.Chowdary, A.C.Johnson, D.J.Tendam, Phys. Rev. 90, 464 (1953).

$In^{111}_{49\ 62}$

γ 0.1708 K/LM = 7.0 s
0.2456 K/LM = 4.8

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

$\gamma\gamma(\theta)$ b = - 0.19 liquid sample
b depends on phase not chemical structure

R.M.Steffen, Phys. Rev. 89, 903A(1953).

$In^{112}_{49\ 63}$ 23^m

τ_1 20.7^m Ag(20-Mev α) chem
γ 0.155 α large K/LM = 3.7 sπ

E. Bleuler, J.W.Blue, S.A.Chowdary, A.C.Johnson, D.J. Tendam, Phys. Rev. 90, 464 (1953).

9^m

τ_2 14.5^m d 21^mIn Ag(20-Mev α)
β^- 44% 0.656 s
β+(+ϵ) 56% 1.52
No $\beta\gamma$

E.Bleuler, J.W.Blue, S.A.Chowdary, A.C.Johnson, D.J.Tendam, Phys. Rev. 90, 464 (1953).

$In^{113}_{49\ 64}$ 1.7^h

γ 0.3917 K/LM = 4.2 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

$In^{113}_{49\ 64}$

μ 5.4966 $In(NO_3)_3$; I
$\mu(In^{113})/\mu(In^{115}) = 0.99787 \pm 0.00004$

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

$In^{114}_{49\ 65}$ 50^d

γ 0.1898 K/LM = 1.00 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

β^- 2.01 50^dIn; s

72^s

V.S.Shpinel, N.V.Forafontov, Zhur. Ekspti' i Teoret. Fiz. 21, 1376(1951).

(β)(possible 1.2γ) <0.3% of β's a/$\beta\gamma$

R.H.Nussbaum, R.Van Lieshout, Physica 19,451. (1953).

$\gamma\gamma(\theta)$; I = 2,2,0 or 4,2,0 50^dIn metallic
γ cascade follows ϵ decay of 72^s state

R.M.Steffen, W.Zobel, Phys. Rev. 88, 170A(1952).

In^{115} 49 66 4.5^h

γ 0.3346 K/LM = 3.8 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

stable

μ 5.5083 $In(NO_3)_3$ $ScCl_3$; I

$\nu(In^{115})/\nu(Sc^{45}) = 0.901877 \pm 0.00005$

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

In^{116} 49 67 54^m

τ_1 $54.14^m \pm 0.07$ In(pile n)

Counted for 5 half-lives with G-M

K.W.Downes, G.A.Price, R.Sher, V.J.Walsh, BNL-216 (T-33).

τ_1 $53.99^m \pm 0.06$ In(pile n)

Counted for 6 half-lives with β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

In^{116}? 49 67

Capture γ's In(n,γ) scin

0.160

0.256

No crossover observed

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

In^{117} 49 68 70^m

τ_1 70^m U(n,f)

β^- and weak γ a

C.D.Coryell, P.Lévêque, H.G.Richter, Phys. Rev. 89, 903A(1953).

$\sim 2.5^h$

τ_2 $\sim 2.5^h$ U(n,f)

β^- and very weak γ a

C.D.Coryell, P.Lévêque, H.G.Richter, Phys. Rev. 89, 903A(1953).

In^{118} 49 69 $<1^m$

τ_2 $<1^m$ d 30^mCd chem

β^- 4.0 a

C.D.Coryell, P.Lévêque, H.G.Richter, Phys. Rev. 89, 903A(1953).

Sn^{113} 50 63 112^d

τ 120^d Sn(pile n) chem

No 0.255γ (<1% of 0.39γ) scin

No 0.401γ (<10% of 0.39γ)

Y.Deschamps, P.Avignon, Compt. rend. 236, 478 (1953).

No $e^-(0.085\gamma)$ < 1% of $e^-(0.392\gamma)$ sl

No $e^-(0.255\gamma)$ < 1% of $e^-(0.392\gamma)$

$e^-(0.401\gamma)$ not resolvable

$e^-(\text{Auger})/[e^-_{KLM}(0.392\gamma)] = 0.56$

$\epsilon_L/\epsilon_K = 0.08$ to 0.17 (if all ϵ to 0.392 level)

Previous value of 0.8 superseded

C.D.Broyles, D.A.Thomas, S.K.Haynes, Phys. Rev. 89, 715(1953).

Sn^{124} 50 74

$\tau_{\beta\beta}$ $>1.5\times10^{17y}$ 95% Sn^{124} scin

J.A.McCarthy, Phys. Rev. 90, 853 (1953).

Sn^{124} 50 74

$\tau_{\beta\beta}$ $>2\times10^{15y}$ ppl

Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Sb^{116} 51 65

τ 15.5^m Sn(>5-Mev p) chem

β^+ 2.40* not Sb($\leq$31-Mev γ)

γ 0.90* sl pe⁻

1.30*

2.20* sl Cpt

β^+ and γ's formerly assigned to $16.6^m Sb^{120}$, q.v.

No 60^mSb found from Sn(6.8-Mev p) chem

P.Stähelin, P.Preiswerk, Nuovo Cim. 10, 1219 (1953).
*Data of J.P.Blaser, F.Boehm, P.Marmier, Helv. Phys. Acta 23, 623 (1950).

Sb^{120} 51 69 16.6^m

τ 16.6^m Sn(5-Mev p) chem

β^+ (1.70)* Sb($\leq$31-Mev γ)

No γ ($E_\gamma >$ 0.60) scin

γ's previously assigned here not produced by Sb($\leq$ 31-Mev γ). Now assigned to Sb^{116}, q.v.

P.Stähelin, P.Preiswerk, Nuovo Cim. 10, 1219(1953).
*J.P.Blaser, F.Boehm, P.Marmier, Helv. Phys. Acta 23, 623 (1950).

Sb^{121} 51 70

q -1.3 S

G.Sprague, D.H.Tomboulian, Phys. Rev. 92,105; 91, 476A (1953).

Sb^{122} 51 71 3.5^m

γ 0.059 $\alpha(0.059\gamma\ ?)\sim 25$

0.074 Sb^{121}(pile n); pc

J.M.Kahn, ORNL-1089(1951).

Sb^{123} 51 72

q -1.7 S

G.Sprague, D.H.Tomboulian, Phys. Rev. 92,105; 91, 476A (1953).

Sb^{124} 51 73 60^d

β^-	14%	0.24	sπ
	49%	0.61	
	9%	0.966	
	7%	1.602	
	21%	2.317	F-K plot not linear

2.3β ΔI = 1,yes ? Not ΔI = 2,yes

γ	0.603	α=0.0034 K/LM=7.9 E2	ce⁻
	0.641		pe⁻
	0.716		
	1.68		
	2.09		

(1.68γ) (0.60γ) (2.09γ) (0.60γ)

L.M.Langer, N.H.Lazar, R.J.D.Moffat, Phys. Rev. 91, 338; 91, 485A (1953).

β^-	10%	0.223	s
	53%	0.609	
	6%	0.871	
	5%	1.581	
	5%	1.658	F-K plot not linear
	21%	2.306	F-K plot not linear

2.3β ΔI = 2,no ? Not ΔI = 2,yes

γ Rel. intensity of ce⁻

0.604 K : L : M = 100 : 13 : 3

0.648 K = 5.4

0.711 ?

$Sb^{124}_{51\ 73}$ 60^d

0.725 K = 7.8
1.697 K = 3.4

E.P.Tomlinson, S.L.Ridgway, K.Gopalakrishnan, Phys. Rev. 91, 484A (1953).

β^- (0.95) $\Delta I = 2$, yes shape? sl
2.27 $\Delta I = 2$, yes shape

		α_K	K/L	
γ	(0.607)	0.0036	7.1	E2
	(1.7)	$\leq 5 \times 10^{-4}$		

D.R.Hutchinson, M.L.Wiedenbeck, Phys. Rev. 88, 699(1952).

γ 0.607 K/LM ~ 15 s ce$^-$

R.E.Maerker, R.D.Birkhoff, Phys. Rev. 89, 1159 (1953).

γ (0.60) $\tau < 2 \times 10^{-9\,s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

					sπ Cpt
γ	154†	0.60	17†	1.35	
	19†	0.71	100†	1.69	
	6.6†	0.96	10†	2.07	
	4.4†	1.05			

K.Gromov et al., Doklady Akad. Nauk SSSR 86, 255(1952).

γ 1.692 sl pe$^-$

D.E.Alburger, Phys. Rev. 88, 1257(1952).

No $\gamma\gamma(\theta)$, no $\gamma\gamma$ polarization-direction scin
(2.27β^-) (0.60γ) (θ), polarization-direction
I = 3, 2+, 0+

R.M.Kloepper, E.S.Lennox, M.L.Wiedenbeck, Phys. Rev. 88, 695(1952).

(2.27β^-)(0.60γ) polarization-direction
0.60γ no parity change

D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 90, 370A (1953).

γ (1.70) (E)1 99.9% $\gamma\gamma(\theta)$
$\alpha = 2.6 \times 10^{-4}$ E1
(1.70γ) (0.60γ) (θ) I = 3,2,0
I(2.3 level Te^{124}) = 3
(2.06γ) (0.60γ) (θ) I = 3,2,0

F.R.Metzger, Phys. Rev. 90, 328(1953).

γ (1.70) (E)1 99.9% $\gamma\gamma(\theta)$
(1.70γ) (0.60γ) (θ) I = 3,2,0

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

(0.60γ) (2.27β) Sb(pile n); scin
(0.60γ) (1.70γ) (0.60γ) (2.06γ)?
(0.60γ) (0.65γ and/or 0.73γ)

S.A.E.Johansson, S.Almquist, Arkiv Fysik 5, 427 (1952); Nature 170, 583(1952).

$Te^{123}_{52\ 71}$ 100^d γ (0.159) $\tau = 1.9 \times 10^{-10\,s}$ $e^-_K e^-_K$

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

$Te^{124}_{52\ 72}$? Capture γ Te(n,γ) scin
0.609

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

$Te^{125}_{52\ 73}$ 58^d γ (0.035) $\tau = 1.6 \times 10^{-9\,s}$ $e^-_L e^-_L$

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

$_{52}Te^{125}_{73}$ γ 0.0355 $\alpha_K = 160$ pc
K : L : M = 5.4 : 3.6 : 1.0
0.110 $\alpha_K = 11$
K : L : M = 40 : 5.5 : 1.0

J.G.Balfour, quoted by S.C.Curran, Physica 18, 1161(1952).

$Te^{130}_{52\ 78}$ $\tau_{\beta\beta}$ $> 10^{17}$y Te chem

M.D. Sharma, Curr. Sci. 22, 45 (1953).

$Te^{130}_{52\ 78}$ $\tau_{\beta\beta}$ $> 4 \times 10^{15\,y}$ ppl
Assuming decay energy $\geq$ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$Te^{131}_{52\ 79}$ 25^m

τ_2		24.8^m	Te(n,γ)	chem
β^-	45%	1.35		a$\beta\gamma$
	55%	2.0		a
γ	30†	0.16		a
	20†	0.7		

$\gamma\gamma$ $\beta\gamma$

K.Geiger, Z. Naturforsch. 7a, 579(1952).

I Neutron resonances (ev) E_n = 5 ev to 5 kev
19.4 $\sigma_0\Gamma^2 = 23$
29.6
43

A.W.Merrison, E.R.Wiblin, Proc. Roy. Soc. 215A, 278(1952).

$I^{121}_{53\ 68}$ τ 1.5^h d 40^mXe, p 17^dTe

B.Dropesky, E.O.Wiig, Phys. Rev. 88, 683(1952).

$I^{122}_{53\ 69}$ τ 3.4^m d 20^hXe

B.Dropesky, E.O.Wiig, Phys. Rev. 88, 683(1952).

$I^{125}_{53\ 72}$ γ 0.0354 d 18^hXe; sl ce$^-$
e^-(Auger) / [e^-_{LM}(0.035γ)] = 1.3
shows ϵ chiefly to 0.035 level

I.Bergström, Arkiv Fysik 5, 191(1952).

$I^{126}_{53\ 73}$

β^-	72.5 †	0.87	I(28-Mev d); sl
	27.5 †	1.26	
β^+	2.7 †	1.21	
γ			sl ce$^-$, pe$^-$ scin
		0.390	α_K = 0.016 K/LM $\geq$ 8 E2
		0.67	

ϵ_K/(0.67γ) ~ 1.25* (0.39γ) / (0.67γ) ~ 1.0
(~ 0.9β^-) (0.39γ) (K x ray) (0.67γ)

*From comparison with Cs^{137} K x ray/γ value

N.Marty, H.Langevin, P.Hubert, Compt. rend 236, 1153(1953).

$I^{127}_{53\ 74}$ |q| 0.69 quad res

T.Kamei, J. Phys. Soc. Japan 7, 649(1952).

Level I(n,n'γ) E_n=14 scin
γ's 0.7-0.8 n'γ
No other γ's observed

R.E. Garrett, F.L.Hereford, B.W.Sloope, Phys.Rev. 91, 441A (1953); verbal report.

$I^{128}_{53\ 75}$ γ 100† 0.455 scin
2† 0.98

A.H. Wapstra, N.F.Verster, M. Boelhouwer, Physica 19, 138 (1953).

$I^{129}_{53\ 76}$ $q(I^{129})/q(I^{127})$ = 0.701213 SnI_4; quad res
±0.000015

R.Livingston, H.Zeldes, Phys. Rev. 90, 609(1953).

β⁻ 0.150 ΔI= 2, no s
γ 0.038 α_K= 19 M1
No 0.188 β (< 1%) scin

E.der Mateosian, C.S.Wu, Phys. Rev. 91, 497A, (1953); verbal report.

$I^{131}_{53\ 78}$ τ 8.07^d±0.02 electroscope
Counted 3 samples for ~5 half-lives

H.H.Seliger, L. Cavallo, S.V.Culpepper, Phys. Rev. 90, 443 (1953).

τ 8.05^d ± 0.01 U(n,f)

R.M.Bartholomew, E.Brown, R.C.Hawkins, W.F. Merritt, L.Yaffe, Can. J. Chem. 31, 120(1953).

τ 8.06^d ± 0.02

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

γ 0.080164 ± 0.000009 cryst
0.284307 ± 0.000049
0.364467 ± 0.000050
Results of new measurement using 1952 calibration

H.C.Hoyt, J.W.M.DuMond, Phys. Rev. 91, 1027(1953).

γ sl pe⁻, ce⁻

		α_K*	K/LM	
6†	(0.284)	0.05	3.3	E2
100†	(0.364)	0.02	5.6	E2
10†	(0.638)	α = 0.004		E2
3†	(0.723)	α = 0.003		E2

*Based on α_K = 0.097 for 0.662γ of Cs^{137}

J.R.Haskins, J.D.Kurbatov, Phys. Rev. 88, 884 (1952).

γ (0.637) α_K=0.0040 E2 s ce⁻, pe⁻
(0.722) α_K=0.0031 E2

J.L.Wolfson, Can. J. Phys. 30, 715(1952).

(0.284γ) (0.080γ) No other γγ scin

S.Almqvist, S.A.E.Johansson, Nature 170, 583 (1952).

$I^{131}_{53\ 78}$ No (0.638γ) (0.080γ) aγγ
(0.284γ) (0.080γ) (θ) isotropic scin

D.Schiff, F.R.Metzger, Phys. Rev. 90, 849 (1953).

$I^{133}_{53\ 80}$ τ 20.8^h ± 0.2 U(n,f); chem

S.Katcoff, W.Rubinson, Phys. Rev. 91,1458(1953).

$I^{134}_{53\ 81}$ Mass assignment of 54^m activity confirmed from U(n,f) cumulative yield of 7.7%
(Xe^{132} yield = 4.2%, Xe^{134} yield = 8.2%; ms)

L.Yaffe, A.E.Day, B.A.Greer, Can. J. Chem 31, 48(1953).

Xe Neutron resonances (ev) E_n = 1.5 ev to 2 kev
9.3
13.9 $\sigma_0\Gamma^2$~1000

S.P.Harris, Phys. Rev. 89, 904A(1953).

$Xe^{121}_{54\ 67}$ τ 40^m p 1.5^hI, I(240-Mev p) chem

B.Dropesky, E.O.Wiig, Phys. Rev. 88, 683(1952).

τ 70^m I(80-Mev p) chem

D.E.Tilley, Proc. Roy. Soc. Canada 46, 135A(1952).

$Xe^{122}_{54\ 68}$ τ 20^h p 3.4^mI, I(240-Mev p) chem

B.Dropesky, E.O.Wiig, Phys. Rev. 88, 683(1952).

τ 19.5^h p 3.4^mI, I(80-Mev p) chem

D.E.Tilley, Proc. Roy. Soc. Canada 46, 135A(1952).

$Xe^{123}_{54\ 69}$ τ 1.7^h p 13^hI, I(240-Mev p) chem

B.Dropesky, E.O.Wiig, Phys. Rev. 88, 683(1952).

τ 2.1^h I(50-Mev p) chem

D.E.Tilley, Proc. Roy. Soc. Canada 46, 135A(1952).

$Xe^{125}_{54\ 71}$ τ 18.0^h Xe(pile n) ms
ε from ratio of Auger e⁻ to ce_K^-

γ	68*	0.054	K/LM = 4.2	sl,
	1*	0.096	K/LM = 5	ce⁻
	1*	0.106	K/LM = 5	
	24*	0.187	K/LM = 4.5	
	7*	0.243	K/LM = 7	
	vw	0.46		scin

*Relative intensity of ce_K^-

I.Bergström, Arkiv Fysik 5, 191(1952).

$Xe^{127}_{54\ 73}$ 34^d τ_2 25^d Xe(pile n) ms
ε from ratio of Auger e⁻ to ce_K^-

γ	34*	0.057	K/LM = 6.2	sl,
	21*	0.145		ce⁻
	41*	0.170		
	84*	0.2026	K/LM = 4.7	s π/2
	vw	0.365		scin

*Relative intensity of ce_K^-

I.Bergström, Arkiv Fysik 5, 191(1952).

Xe^{131} 54 77 12^d

τ 12.0^d d 8^dI ms
γ 0.1639 $\alpha_K = 36$ M4 $s\pi\sqrt{2}$
K/L = 2.3 L/M = 2.9

I.Bergström, Arkiv Fysik 5, 191(1952).

stable
q -0.12 s
μ +0.683 s

A.Bohr, J.Koch, E.Rasmussen, Arkiv Fysik 4, 455 (1952).

Xe^{133} 54 79 5.3^d

τ 5.4^d Xe(pile n) U(n,f) ms
β^- 0.347 sl
γ 0.081 $\alpha_K = 1.5$ M1
K/LM = 4.9
$[e^-(0.08\gamma)][\beta]$

I.Bergström, Arkiv Fysik 5, 191(1952).

Xe^{133} 54 79

γ (0.08) $\alpha_K = 1.8$ K/LM = 6 M1
$\tau = 6 \times 10^{-9s}$ $\beta^- e_K^-$

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

Xe^{135} 54 81 9.2^h

τ_2 9.13^h U(n,f) chem

F.Brown, L.Yaffe, Can. J. Chem. 31, 242(1953).

τ_2 9.2^h Xe(pile n) U(n,f) ms
β^- 0.91 sl
γ 100† 0.25 $\alpha_K = 0.054$ M1,E2
K/LM = 6.5 sl ce^-, scin
6† 0.61 scin
$[e^-(0.25\gamma)][\beta]$
0.053, 0.148, 0.190 γ's not found

I.Bergström, Arkiv Fysik 5, 191(1952).

γ (0.25) $\tau = 2.8 \times 10^{-10s}$ $\beta^- e_K^-$
K/LM = 5.6

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

Xe^{145} 54 91

Existence of 0.8^sXe activity in doubt
Previously reported as p $1.8^h Ce^{145}$, q.v.

A.A.Caretto, Jr., S.Katcoff, Phys. Rev. 89, 1267 (1953).

Cs^{127} 55 72

γ 0.125 I(56-Mev α)
0.41 scin

A.H.Wapstra, N.F.Verster, M.Boelhouwer, Physica 19, 138 (1953).

Cs^{128} 55 73

τ 3.5^m d 2.4^d Ba
β^+ 1.1 ± 0.7 chem $\alpha/\beta\gamma$
3.1 s
γ 100† 0.135 scin
0.29
30† 0.455
w 0.97
$(\sim 1.1\beta)(\gamma)$ $\gamma\gamma$ No $(3.1\beta)(\gamma)$
γ's could belong to Ba^{128}

R.W.Fink, E.O Wiig, Phys. Rev. 91, 194 (1953).

Cs^{128} 55 73

τ 3.9^m I(56-Mev α)
γ ~0.46 scin
1.5
(K x ray)/β^+ = 0.4

A.H. Wapstra, N.F.Verster, M.Boelhouwer, Physica 19, 138 (1953).

τ 3.8^m d 2.4^dBa chem
β^+ observed with 2.4^dBa belongs to this daughter

M.Lindner, R.N.Osborne, Phys. Rev. 88, 1422(1952).

Cs^{129} 55 74

γ 95† 0.385 I(56-Mev α)
5† 0.560 scin
0.040 γ not observed

A.H. Wapstra, N.F.Verster, M.Boelhouwer, Physica 19, 138 (1953).

Cs^{132} 55 77

γ 0.69 Cs(26-Mev d)
scin

A.H. Wapstra, N.F.Verster, M.Boelhouwer, Physica 19, 138 (1953).

Cs^{134} 55 79 2.3^y

β^- 10% ~0.08 Cs(pile n)
3% ~0.21 $s\pi\sqrt{2}$
6% 0.410
81% 0.657
0.202* 0.797 7.3
0.475 ~ 5 0.803*
0.563 ~10 1.039 ~10
0.570* 1.168 ~10
0.605 6.4 1.368 ~10
0.663* s ce^-, pe^-
* ce_K^- only observed

J.M.Cork, J.M.LeBlanc, W.H.Nester, M.K.Brice, Phys. Rev. 89, 907A; 90, 444 (1953).

β^- 22% 0.085* Cs(slow n); s
6% 0.28*
9% 0.42*
65% 0.65*
γ 137^+ (~0.58) 3^+ 1.15 s pe^-
100^+ 0.788 3^+ 1.35
$\sim 2^+$ ~1.0

K.Gromov, B.Dzhelepov, Doklady Akad. Nauk SSSR 85, 299(1952). *N.Anton'eva et al., ibid. 81

γ 0.602 K/LM = 6.6 s ce^-
0.799 K/LM = 7.8

R.E.Maerker, R.D.Birkhoff, Phys. Rev. 89, 1159 (1953).

$\gamma\gamma(\theta)$, $\gamma\gamma$ polarization-direction scin
I = 4+, 2+, 0+

R.M.Kloepper, E.S.Lennox, M.L.Wiedenbeck, Phys. Rev. 88, 695(1952).

$\gamma\gamma$ polarization correlation observed
Consistent with 5±, 4+, 2+, 0+

B.L.Robinson, L.Madansky, Phys. Rev. 88, 1065 (1952).

Cs^{135} 55 80

β^- 0.210 $\Delta I = 2$, no shape s

L.Lidofsky, E.Alperovitch, C.S.Wu, Phys. Rev. 90, 387A(1953); verbal report.

Cs^{137} 55 82

τ 33^y U(n,f) chem ms
Calc. from Cs^{137}/Cs^{133} ratios measured between 4.2 and 5.4 years after fission

D.R.Wiles, B.W.Smith, R.Horsley, H.G.Thode, Can. J. Phys. 31, 419(1953).

β^- 0.512 $\Delta I = 2$, yes shape sl
1.20 $\Delta I = 2$, no

C.D.Broyles, D.A.Thomas, S.K.Haynes, Phys. Rev. 89, 715(1953).

γ 0.663 K/LM = 4.52 s ce$^-$

R.E.Maerker, R.D.Birkhoff, Phys. Rev. 89, 1159 (1953).

γ 0.6614 K/LM = 4.6 s

G.A.Graves, L.M.Langer, R.D.Moffat, Phys. Rev. 88, 169A and 344(1952).

γ 0.66165 $\pm$0.00015 s $\pi\sqrt{2}$ ce$^-$ pe$^-$

G.Lindström, K.Siegbahn, A.H.Wapstra, Proc. Phys. Soc. 66B, 54(1953).

γ 0.66160 $\pm$0.00014 cryst

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775(1952).

Cs^{138} 55 83

τ		32^m	U(n,f) chem
β^-		3.40	F-K plot not linear sl
γ	33†	0.463	sl ce, scin
	43†	0.98	scin
	100†	1.44	scin

($\sim 3\beta^-$)(1.44γ ?)
(1.44γ)(0.46γ ?) (1.44γ)(0.98γ ?)

L.M.Langer, R.B.Duffield, C.W.Stanley, Phys. Rev. 89, 907A(1953).

Ba^{127} 56 71

τ 12^m p 5.5^hCs, Cs(190-Mev d)

M.Lindner, R.N.Osborne, Phys. Rev. 88, 1422(1952).

Ba^{128} 56 72

τ 2.4^d Cs(240-Mev p)
ϵ 100% p 3.5^m Cs chem
See Cs^{128} for possible γ's

R.W.Fink, E.O Wiig, Phys. Rev. 91, 194 (1953).

ϵ $\sim$100% Cs(190-Mev d) chem
β^+ in 3.8^mCs daughter

M.Lindner, R.N.Osborne, Phys. Rev. 88, 1422(1952)

Ba^{129} 56 73

β^+ 1.6 Ca(60-Mev p) s chem

R.W.Fink, E.O.Wiig, Phys. Rev. 91, 194 (1953).

Ba^{131} 56 75

τ 11.8^d Ba^{130}(pile n)

γ	K/L		K/L
0.055	$\leq$1	0.249	$\geq$6
0.079	10	0.374	6.0
0.092		0.489	
0.124	3.6	0.498	7.7
0.133	5.8	0.585	
0.216	9	0.620	
0.239	$\geq$8		s ce$^-$, pe$^-$

No 0.82 or 1.2 γ scin

J.M.Cork, J.M.LeBlanc, W.H.Nester, M.K.Brice, Phys. Rev. 91, 76; 91, 497A (1953).

γ Ba(pile n); s

		a_K	K/LM	
	0.043			ce$^-$
	0.065		$\sim$3.5	
	0.108		$\sim$7	
	0.122		6.0	
10†	0.214	$\sim$0.18	2.8	E2 ce$^-$,pe$^-$
4†	0.241			
7†	0.370	$\sim$0.010		E1
100†	0.494	$\sim$0.0045	2.5	E2

M.W.Elliott, L.S.Chen, J.R.Haskins, J.D.Kurbatov, Phys. Rev. 88, 263(1952).

γ Ba(pile n) chem scin

γ	w	$\sim$0.10
	55†	0.122
	45†	$\sim$0.220
	25†	0.370
	100†	0.500
	6†	0.620
	3†	0.90*
	3†	1.02*
x	145†	K x ray

(0.12γ)(0.50γ) *Possible impurities

W. Payne, M.Goodrich, Phys. Rev. 91, 497A (1953); verbal report.

Ba^{133} 56 77 39^h

γ (0.012) $\tau < 0.02^{\mu s}$

M.Langevin, Compt. rend 236, 689(1953).

γ 0.276 Ba(pile n)

J.M. Cork, J.M.LeBlanc, W.H.Nester, M.K.Brice, Phys. Rev. 91, 76 (1953).

Ba^{135} 56 79 29^h

γ 0.268 Ba(pile n)

J.M. Cork, J.M.LeBlanc, W.H.Nester, M.K.Brice, Phys. Rev. 91, 76 (1953).

Ba^{138} 56 82

$\tau_{\beta\beta}$ $> 10^{15y}$ ppl
Assuming decay energy $\geq$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Ba^{140} 56 84

γ 0.540 K/LM$\sim$6 s ce$^-$

R.E.Maerker, R.D.Birkhoff, Phys. Rev. 89, 1159 (1953).

La

No neutron resonances E_n=0.1 to 30 ev

V.L. Sailor, H.H.Landon, H.L.Foote, Phys. Rev. 91 450A (1953).

La^{135} 57 78

γ 6† 0.49 Ba(26-Mev d)
1† 0.66 chem scin
x 300† K x ray

A.H.Wapstra, Physica 19, 671 (1953).

La^{140} 57 83

τ 40.2^h La(pile n)

R.M.Bartholomew, F.Brown, R.C.Hawkins, W.F.Merritt, L.Yaffe, Can. J. Chem. 31, 120(1953).

γ 0.3286 ± 0.0003 $s\pi\sqrt{2}$ pe^-
0.4867 ± 0.0004
0.8151 ± 0.0007
1.596 ± 0.002

A.Hedgran, D.Lind, Arkiv Fysik 5, 177(1952).

γ 0.488 K/LM= 3.7 s ce^-

R.E.Maerker, R.D.Birkhoff, Phys. Rev. 89, 1159 (1953).

Capture γ La(n,γ) scin
4.5

B.Hamermesh, V.Hummel, Phys. Rev. 88, 916(1952).

La^{142} 57 85

β^- >2.5 U(n,f) chem; a
γ 90† 0.63 scin
10† 0.87
(<2.5β) (γ)

A.V. Bosch, Physica 19, 374 (1953).

Ce

No neutron resonances E_n=0.1 to 30 ev

V.L.Sailor, H.H.Landon, H.L.Foote, Phys. Rev. 91, 450A (1953).

No fission product Ce with $6^m < \tau < 13.9^m$ chem

A.A.Caretto, Jr., S.Katcoff, Phys. Rev. 89, 1267 (1953).

Ce^{141} 58 83

γ (0.145) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

Ce^{143} 58 85

β^- 100† 0.71 Ce^{142}(pile n,γ),
133† 1.090 U(pile n,f) chem
100† 1.390
γ ~20† 0.126 sl pe^-, scin
~0.160
100† 0.290
~20† 0.356
~25† 0.660
0.72
Unresolved lower energy β
(0.126γ)(0.160γ)

W.H.Burgus, Phys. Rev. 88, 1129(1952).

Ce^{145} 58 87

No 1.8^hCe activity U(n,f) chem
Previously reported activity due to 2.0^hNd impurity?

A.A.Caretto, Jr., S.Katcoff, Phys. Rev. 89, 1267 (1953).

Ce^{146} 58 88

τ 13.9^m D 24.4^mPr U(n,f) chem
β^- ~0.9 a
γ ~0.2 a

A.A.Caretto, Jr., S.Katcoff, Phys. Rev. 89, 1267 (1953).

Pr

No neutron resonances E_n=0.1 to 30 ev

V.L.Sailor, H.H.Landon, H.L.Foote, Phys. Rev. 91, 450A (1953).

Pr^{140} 59 81

β+ 2.4 Pr(≲70-Mev γ)
scin

F.I.Boley, Iowa State Coll. J. Sci. 27,129(1953).

Pr^{141} 59 82

I 5/2 para

C.F.Davis et al, Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. 11, 77(1951). NSA 6-3679.

μ +3.9 S
Calculated from data of White, Phys. Rev. 34, 1397(1929)

P.Brix, Phys. Rev. 89, 1245(1953).

μ +3.8 M
Q -0.054

H.Lew, Phys. Rev. 91, 619; 89, 530 (1953).

Pr^{144} 59 85

γ (0.695) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

$\gamma\gamma$ polarization - direction scin
I = 1-,2+,0+

D.M.Roberts, Phys. Rev. 91, 497A (1953); verbal report.

Pr^{145} 59 86

No 4.5^hPr activity U(n,f) chem
Previously reported activity due to 3.7^hLa impurity?

A.A.Caretto, Jr., S.Katcoff, Phys. Rev. 89, 1267 (1953).

Pr^{146} 59 87

τ 24.4^m d 13.9^mCe U(n,f) chem
β^- 3.8 a

A.A.Caretto, Jr., S.Katcoff, Phys. Rev. 89, 1267 (1953).

Nd

Relative abundances

A	142	143	144	145
%	27.09	12.14	23.83	8.29
A	146	148	150	
%	17.26	5.74	5.63	

W.H.Walker, H.G.Thode, Phys. Rev. 90,447 (1953).

Nd^{147} 60 87

γ (0.092) $\tau = 2.44 \times 10^{-9s}$
α_k= 1.8 K: L: M= 29:4:1

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

Pm^{142} ? 61 81 | τ 260^d Nd^{142}(7-Mev p)

J.K.Long, M.L.Pool, D.N.Kundu, Phys. Rev. 88, 171A(1952).

Pm^{143} ? 61 82 | τ 320^d Nd^{143}(7-Mev p)

J.K.Long, M.L.Pool, D.N.Kundu, Phys. Rev. 88, 171A(1952).

Pm^{145} ? 61 84 | τ 16^d Nd^{145}(7-Mev p)
β^+ 0.45

J.K.Long, M.L.Pool, D.N.Kundu, Phys. Rev. 88, 171A(1952).

Pm^{146} 61 85 | τ $\sim 2^y$ Nd^{146}(7-Mev p)
β^- 0.75

J.K.Long, M.L.Pool, D.N.Kundu, Phys. Rev. 88, 171A(1952).

Sm | Neutron resonances (ev)* E_n = 0.1ev to 40ev
3.43** 19
12 ? 22
15.2
*Isotopic assignment uncertain
**Not Sm 149, 152, or 154

V.L.Sailor, H.L.Foote, Jr., H.H.Landon, Phys. Rev. 89, 904A(1953); priv. comm.

Sm^{147} 62 85 | E_a 2.12 ± 0.03 ppl

D.Szteinsznaider, J. Phys. radium 14, 465(1953).

Sm^{149} 62 87 | Neutron resonances (ev) E_n = 0.1ev to 40ev
0.094
0.87
4.95

V.L.Sailor, H.L.Foote, Jr., H.H.Landon, Phys. Rev. 89, 904A(1953); priv. comm.

Sm^{150} 62 88 | Capture γ's $Sm^{149}(n,\gamma)$ sπ ce$^-$
0.337 K/L$\sim$4.4
0.440 K/L$\sim$3

C.T.Hibdon, C.O.Muehlhause, Phys. Rev. 88, 943 (1952); 87, 222A(1952).

Sm^{151} 62 89 | β^- $\sim$0.075 Sm(th n); pc
γ 0.019 pc
$(0.019\gamma)(\beta^-)$ scin

H.W.Wilson, G.M.Lewis, Proc. Phys. Soc. 65A, 656 (1952).

Sm^{152} 62 90 | Neutron resonance (ev) E_n = 0.1ev to 40ev
8.20

V.L.Sailor, H.L.Foote, Jr., H.H.Landon, Phys. Rev. 89, 904A(1953); priv. comm.

Sm^{153} 62 91 | β^- 9% 0.255 sπ
<2% 0.62?
70% 0.685
21% 0.795
γ 0.0691 sπ ce$^-$
0.1027
0.548

R.Katz, M.R.Lee, Phys. Rev. 92, 848A(1953).

Eu | Neutron resonances (ev) E_n=0.1 to 30 ev

0.46	2.72	7.32
1.06	3.35	8.95
1.77	3.85	15.2
2.47	6.2	20

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 91, 450A (1953); verbal report.

Eu^{147} 63 84 | τ 24^d Sm^{147}(6.7-Mev p)
γ 0.12 scin
0.21 sπ ce$^-$
No β+

R.C.Mack, J.J.Neuer, M.L.Pool, Phys. Rev. 91,497A (1953).

Eu^{148} 63 85 | τ 54^d Sm^{148}(6.7-Mev p)
γ 0.58 sπ ce$^-$

R.C.Mack, J.J.Neuer, M.L.Pool, Phys. Rev. 91,497A (1953).

Eu^{149} 63 86 | τ 120^d Sm^{149}(6.7-Mev p)
γ 0.30 scin, sπ ce$^-$
0.57

R.C.Mack, J.J.Neuer, M.L.Pool, Phys. Rev. 91,497A (1953); verbal report.

Eu^{150} 63 87 | τ 13.7^h Sm^{150}(6.7-Mev p)
β^- 1.07 sπ
No β+
F-K plot complex? but no γ, no ce$^-$

R.C.Mack, J.J.Neuer, M.L.Pool, Phys. Rev. 91,903; 91, 497A (1953).

Eu^{152} 63 89 5.3^y | τ_2 $12.4^y \pm 0.4$ Eu(pile n)
Counted for 1.1 years with β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

τ_2 $15.6^y \pm 1.5$ Eu(pile n)
Counted for 200 days with ic

J.Kastner, Can. J. Phys. 31, 169(1953).

$Eu^{152,154}$ 63 | γ 1.40 sπ pe$^-$

L.Y.Shavtvalov, Zhur. Ekspt'l i Teoret. Fiz. 23, 611(1952).

Eu^{155} 63 92 | β^- $\sim$0.150 Sm(th n,$\gamma\beta^-$); pc
$\sim$0.250
γ 0.015 pc
$(\sim 0.150\beta^-)(\gamma)$ $(\beta^-)(0.015\gamma)$

H.W.Wilson, G.M.Lewis, Proc. Phys. Soc. 65A, 656 (1952).

Gd | Neutron resonances (ev) E_n= 0.7 to 1000 ev

1.93	14.4	49
2.58*	16.6	81
2.85*	20.6*	109
6.26	22.2*	355
7.74	29.8	740
11.6	33.2	

E_o=2.58 σ_o=1600 Γ = 0.07 ev
* Most prominent

R.R.Palmer, L.M.Bollinger, Phys. Rev. 91,450A (1953); verbal report.

$_{64}Gd^{148}_{84}$?
τ >35^y Sm^{147}(32-Mev d) Eu(32-Mev p);
α >25%* 3.2 ion chem yield; ic
No 7^h activity found Sm(30-Mev α) ion chem
(7.5^hAt from Bi impurity?)
*Assuming σ(36-Mev α,3n) = 1

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

$_{64}Gd^{149}_{84}$
ϵ Sm^{147}(31-Mev α) not Sm(19-Mev d).
α ~0.0007% 3.0 ion chem; ic

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

$_{64}Gd^{150}_{86}$
τ_α >10^{5y} ic cc
No α daughter from 13.7^h Eu found

R.C.Mack, J.J.Neuer, M.L.Pool, Phys. Rev. 91,903 (1953).

$_{64}Gd^{150}_{86}$?
α 2.7 Eu(19-Mev d) chem; ic

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

$_{64}Gd^{153}_{89}$
γ 0.1037 K/L = 5 sπ ce⁻
No other γ Gd(pile n)

J.M.Cork, J.M.LeBlanc, W.H.Nester, F.B.Stumpf, Phys. Rev. 88, 685(1952).

$_{64}Gd^{156\}}_{158\}}$
Capture γ's Gd(n,γ) sπ ce⁻
0.079 K/L~0.3 L/M~2.5
0.088
0.180

C.T.Hibdon, C.O.Muehlhause, Phys. Rev. 88, 943 (1952); 87, 222A(1952).

$_{65}Tb^{149}_{84}$
τ 4.1^h Eu(60-Mev α)
ϵ ? Gd(31-Mev p); ion chem
α 3.95
No β^+

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

$_{65}Tb^{151}_{86}$?
τ 19^h Gd(100-Mev p) Eu(45-Mev α)
α >0.0004%* 3.4 ion chem; ic

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953); *M.A.Rollier, J.O.Rasmussen, ibid.

$_{65}Tb^{157}_{92}$
τ >100^y or <30^m
Not observed from Tb(24-Mev p) or as d of 8.2^h Dy

T.H.Handley, E.L.Olson, Phys. Rev. 90,500 (1953).

$_{65}Tb^{161}_{96}$
τ 6.8^d Gd(pile n); sπ ce⁻
γ 0.049 L/M = 3.7
No other γ

J.M.Cork, J.M.LeBlanc, W.H.Nester, F.B.Stumpf, Phys. Rev. 88, 685(1952).

Dy
Neutron resonances (ev) : E_n = 0.1 to 30 ev

1.72	5.47	16.8
2.72	7.8	19.5
3.7	10.6	29.5
4.3	13.5	38.5

V.L.Sailor, H.H.Landon, H.L.Foote, Jr., Phys. Rev. 91, 450A (1953); verbal report.

$_{66}Dy^{\geq 149\}}_{\leq 153\}}$
τ 19^m Tb(100-Mev p)
α 4.1 not Eu(120-Mev α); ic

τ 2.3^h Tb(100-Mev p); ion chem
α 3.6 Nd(~100-Mev C^{12}); ic

τ 7^m Tb(100-Mev p)
α 4.2 Nd(~100-Mev C^{12}); ic
not Eu(120-Mev α)

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

$_{66}Dy^{157}_{91}$
τ 8.2^h Tb(19-Mev p)
γ 0.325 ion chem,rel σ
No β+ or e⁻ observed scin

T.H. Handley, E.L.Olson, Phys. Rev. 90,500(1953).

$_{66}Dy^{165}_{99}$
1.3^m
γ 0.102 Dy(pile n); scin

J.H.Kahn, ORNL-1089(1951).

γ 0.1080 Dy(pile n)
K : L_{II} : L_{III} : M: N
3 : 10 : 10 : 5: 1.5
0.155? scin, sπ ce⁻
0.361
0.515
(~ 1β) (0.36γ,0.52γ) No (0.36γ) (0.52γ)

W.C. Jordan, J.M.Cork, S.B.Burson, Phys. Rev. 91, 497A (1953); verbal report.

2.4^h
γ 0.0944 Dy(pile n)
K :L :M
60 :7.8 :1.5
0.279 K/L >5 sπ ce⁻
0.361 K/L >5
0.634
0.71
1.02
(~ 0.3β) (0.28γ,0.36γ,0.63γ)
(~ 1.3β) (0.094γ)
(0.28γ) (0.71γ) (0.36γ) (0.63γ) No other $\gamma\gamma$

W.C. Jordan, J.M.Cork, S.B.Burson, Phys. Rev. 91, 497A (1953).

$_{66}Dy^{165}_{99}$
Capture γ's Dy(n,γ) sπ ce⁻
0.082
0.106
0.189

C.T.Hibdon, C.O.Muehlhause, Phys. Rev. 88, 943 (1952); 87, 222A(1952).

Ho

Neutron resonances (ev) E_n = 0.1 to 30 ev
3.96 cryst s
12.8

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 362A(1953).

Ho ?

τ ~4^m Dy(200-Mev p)
α 4.2 Sm(100-Mev C^{12})? ic
No Ho α activity observed with τ >1^h
Er(200-Mev p) Yb(250-Mev p); ion chem

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

Er

Neutron resonances (ev) E_n = 0.1 to 30 ev
0.51 9.55 21.2 cryst s
6.10 16.0 27.5

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 362A(1953).

No Er α activity observed with τ >1^h
Er(200-Mev p) Yb(250-Mev p); ion chem

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

Er^{167} 68 99

|q| 10.2 para

G.S.Bogle, H.J.Duffus, H.E.D.Scovil, Proc. Phys. Soc. 65A, 760(1952).

Tm

Neutron resonances (ev) E_n = 0.1 to 30 ev
3.96 cryst s
15.0
18.0

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 362A(1953).

No Tm α activity observed with τ >1^h
Er(200-Mev p) Yb(250-Mev p); ion chem

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33(1953).

Tm^{170} 69 101

β^- 24% 0.884 Tm(pile n); sl $\beta\gamma$
76% 0.968 sl
γ 0.0841 $\tau = 1.57 \times 10^{-9s}$
$\alpha_K = 1.6$ $\alpha_L = 4.1$ $\alpha_M = 1.2$ E2
ϵ_K < 0.3% (β) (0.084γ)
No other γ's (< 0.02%)
F - K plots of both β's linear

R.L.Graham, J.L.Wolfson, R.E.Bell, Can. J. Phys. 30, 459(1952).

Yb

Neutron resonances (ev) E_n = 0.1 ev to 40 ev
0.597 13.3
4.55 18.2
8.09 30

V.L.Sailor, H.L.Foote, Jr., H.H.Landon, Phys. Rev. 89, 904A(1953).

Yb 70 ? 6^s

γ 0.21 Yb(pile n); scin
0.10 (Dy impurity ?)

J.H.Kahn, ORNL - 1089(1951).

Lu

Neutron resonances (ev) E_n = 0.1 to 30 ev
1.57 5.3 14.4 cryst s
2.62 11.4 24.0
4.80

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 362A(1953).

Lu^{176} 71 105 2.4×10^{10y}

τ_{β^-} 2.0×10^{10y} 92 β's/sec/g Lu*
200 γ's/sec/g Lu
β^- ~0.4 a
γ 100 † 0.20 scin
100 † 0.32
(0.32γ) (0.20γ) (0.4β) (γ)
No 0.52γ (< 10%) 0.090γ not observed
x ray/disintegration ~0.35
accounted for by γ conversion

J.R.Arnold, T.Sugihara, Phys. Rev. 90, 332(1953); *A.D.Suttle, Jr., ibid.

Lu^{176} 71 105

Neutron resonance (ev) cryst s
0.142

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 362A(1953); verbal report.

Lu^{177} 71 106

(0.206γ) (0.112γ) b = - 0.20
I = 5/2, 7/2, 3/2 (E) 1, (E) 2

T.Wiedling, Arkiv Fysik 6, 39(1953).

Hf

Relative abundances HfF_4; ms

A	174	176	177
%	0.199	5.23	18.55
A	178	179	180
%	27.23	13.73	35.07

J.H.Reynolds, Phys. Rev. 90, 1047 (1953).

Neutron resonances (ev) E_n = 0 to 100 ev
One each in Hf^{178}, Hf^{180}, ~25 in Hf^{177} or Hf^{179}
None in Hf^{174} or Hf^{176}

D.J.Hughes, W.Y.Kato, J.S.Levin, Phys. Rev. 92, 1094A(1953).

Hf^{179} 72 107 19^s

γ 0.22 Hf(pile n); scin

J.H.Kahn, ORNL - 1089(1951).

Hf^{181} 72 109

γ 0.133 E2
$L_I : L_{II} : L_{III}$ = 0.20: 1.22: 1.00

J.B.Swan, R.D.Hill, Phys. Rev. 91, 424(1953).

γ (0.133) τ = $17.2^{\mu s}$ βce$^-$

R.Ballini, Ann. Phys. 8, 441 (1953).

Level (0.48) $\tau = 1.04 \times 10^{-8s}$ (ce$^-$)(γ)

T.C.Engelder, Phys. Rev. 90, 259(1953).

Level (0.48) τ = 1.06×10^{-8s} $\gamma\gamma$

H.deWaard, Physica 18, 1151 (1952).

Ta^{181} 73 108

μ 1.9 s
q +5.9

B.M.Brown, D.H.Tamboulian, Phys. Rev. 88, 1158 (1952).

Levels Ta(p,p′γ) E_p = 1.0 to 2.2
γ 0.137 ± 0.005 scin
0.300 ± 0.010
σ for E_p = 1.0–2.2 agrees with collective model prediction for E2 coulomb excitation

T.Huus, Č.Zupančič, Kgl. Danskab. Selskab, Mat-fys. Medd. 28, No. 1 (1953).

γ's Ta(p,p′γ) E_p = 1.42
0.138 scin
0.35?
0.50?

C.L.McClelland, C.Goodman, Phys. Rev. 91, 760 (1953).

γ Ta(γ,γ′) $E_\gamma \lesssim 6.5$
0.130 τ = 16±3μs scin

h.N.Brown, R.A.Becker, Phys. Rev. 90, 328 (1953).

Ta^{182} 73 109 117ᵈ

γ			
0.9†	0.065714	1.9†	0.17936
10.0†	0.067736	0.9†	0.19830
0.6†	0.084667	4.5†	0.22205
4.6†	0.10009	2.4†	0.22927
0.9†	0.11366	2.7†	0.26409
0.2†	0.11640	35.2†	1.121
4.3†	0.15241	15.7†	1.188
1.4†	0.15637	33.4†	1.223

No Hf x ray Ta(pile n), cryst
Possible decay schemes enumerated

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775 (1952).

γ 0.22 0.29 1.23 sl pe⁻
0.25 0.31 1.24
0.27 1.01
0.28 1.13

R.M.Pearce, K.C.Mann, Can. J. Phys. 31, 592 (1953).

Ta^{183} 73 110

τ ~6ᵈ $Ta^{181}(n,\gamma)Ta^{182}(n,\gamma)Ta^{183}$
γ 0.246 sπ ce⁻
Numerous other weak ce⁻

J.W.Mihelich, Phys. Rev. 91, 427 (1953).

W

W(p,p) E_p = 1.8
γ ~0.115 scin
Broad peak presumed to be 0.102 γ of W^{180} and 0.123 γ of W^{186} produced by E2 coulomb excitation

T.Huus, Č.Zupančič, Kgl. Danskab. Selskab, Mat.-fys. Medd. 28, No. 1 (1953).

$W^{178?}$ 74 104

τ(atomic) 2.2×10^{17y} ppl
α 3.2
τ(calc) ~ 6×10^{8y}, ∴ abundance of isotope responsible ~ 2.5×10^{-9}. Suggest W^{178}

W.Porschen, W.Riezler, Naturf. 8a, 502 (1953).

W^{185} 74 111

No 0.134 γ W(pile n)
scin, sπ ce⁻

N. Lazar, R.J.D.Moffat, L.M.Langer, Phys. Rev. 91, 498A (1953).

W^{186} 74 112

$\tau_{\beta\beta}$ $>6\times10^{15y}$ ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911 (1952).

W^{187} 74 113

τ 23.85ʰ W(slow n)

G.G.Eichholz, Phys. Rev. 89, 525 (1953).

τ 24.0ʰ W^{186}(pile n,γ)
β⁻* 80% 0.622 sπ√2
20% 1.304

γ	K/L		K/L
0.072		0.513	
0.106		0.552 ?	
0.114		0.619	4
0.134	5.5	0.626	
0.206		0.686	5
0.239		0.774	
0.246		0.866	
0.480	4.2		

L_I/L_{III} ~60 for 0.134γ

J.M.Cork, M.K.Brice, W.H.Nester, J.M.LeBlanc, D.W.Martin, Phys. Rev. 89, 1291 (1953); *A.E. Stoddard, ibid.

γ (0.13) $\tau < 2\times10^{-9s}$ βγ

T.C.Engelder, Phys. Rev. 90, 259 (1953).

γ 0.07200 cryst
0.13425
0.4795
0.6189
0.6861
0.6189γ not crossover

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775 (1952).

γ			
0.072	α_K~2	α<2.5	E1 pc
0.134	α_K~2		M1
0.480			
0.552			
0.686			E1
0.78			

(0.48γ)(0.13γ) (0.55γ)(0.13γ) (0.78γ)(0.13γ)
No (0.618γ)(γ)
No 0.206γ (< 3% of 0.134γ)
0.48γ precedes 0.072γ

A.W.Sunyar, Phys. Rev. 90, 387A (1953); verbal report

Re

Neutron resonance (ev) cryst s
2.16

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 363A (1953).

Re^{185} 75 110

I 5/2 Mic
$q(Re^{185})/q(Re^{187}) = 1.06$

A.Javan, G.Silvey, C.H.Townes, A.V.Grosse, Phys. Rev. 91, 222A(1953).

Re^{186} 75 111

β^- 0.08% (~0.3)

J.E. Robinson, C.E.Whittle, P.S.Jastram, Phys. Rev. 91, 498A (1953).

γ 0.137 $L_{II}/L_{III} = 1.24$ E2

J.B.Swan, R.D.Hill, Phys. Rev. 91, 424(1953).

γ (0.137) $\tau = 1.8\times10^{-9}$s

C.C.McMullen, M.W.Johns, Phys. Rev. 91, 418(1953).

$(0.93\beta)(0.14\gamma)(\theta)$ b <0.0007

C.E. Whittle, J.P.Hurley, P.S.Jastram, Phys. Rev. 91, 498A (1953); verbal report.

Re^{187} 75 112

I 5/2 Mic
$q(Re^{185})/q(Re^{187}) = 1.06$

A.Javan, G.Silvey, C.H.Townes, A.V.Grosse, Phys. Rev. 91, 222A(1953).

β^- ~0.034 ppl

B.Gauthe, J.M.Blum, Compt. rend. 236, 1255(1953).

β^- ~0.40* 3rd forbidden? pc
No x ray or γ
Spectral shape similar to Rb^{87}
β counts less than background

D.Dixon, McNair, quoted by S.C.Curran, Physica 18, 1161(1952); Nature 170, 512(1952).
*Decimal point as assigned in these references.

Re^{188} 75 113 22^m

τ_1 18.7^m Re(slow n)
γ 0.06 α~2 a
p 18^hRe* Szilard-Chalmers chem

A.Flammersfeld, Z. Naturf. 8a, 217(1953); *W.Herr, Z. Naturf. 7a, 819(1952).

τ_1 22^m Re^{187}(pile n)
γ 0.0635 s ce$^-$
0.105
$\gamma\gamma$ (Re x ray + 0.06γ)/(0.105γ) ≥ 10 scin

J.W.Mihelich, Phys. Rev. 89, 907A(1953).

18^h

γ 0.153 sl
0.485
0.645
1.4
$(0.65\gamma)(1.4\gamma)$

C.C.Mullen, H.E.Petch, M.W.Johns, Proc. Roy. Soc. Canada 44, 194A(1950).

γ	~130†	0.1553	$\tau = 1.7\times10^{-9}\mu$s
	10†	0.4782	$s\pi\sqrt{2}$ pe$^-$
	15†	0.6331	
	1†	0.674	
	5†	0.828	
	6†	0.931	
	1†	1.132	
	2†	1.608	

No 1.43γ (< 0.5†)

C.C.McMullen, M.W.Johns, Phys. Rev. 91, 418 (1953). Proc. Roy. Soc. Canada 44, 194A(1950).

Os^{185} 76 109

γ 0.163 s ce$^-$
0.234
0.645 K/L~6
0.879

J.M.Cork, J.M.LeBlanc, W.H.Nester, D.W.Martin, M.K.Brice, Phys. Rev. 90, 444(1953).

γ 0.654 Os (pile n); sl ce$^-$
0.88

J.B.Swan, R.D.Hill, Phys. Rev. 88, 831(1952).

Os^{191} 76 115 14^h

τ_1 14^h Os($\leqslant$22-Mev γ) Os(pile n)
No β^- (<5%) sπ
γ IT 0.0742 sπ ce$^-$ (Os)

L_I	L_{II}	L_{III}	M_I	M_{III}	N
42	24	100	14	35	15

J.B.Swan, R.D.Hill, Phys. Rev. 88, 831(1952).

γ (0.074) E3(73%) M4(27%)
From α_L's, e_L^-(0.074 IT γ)/e_L^-(0.13 g.s. γ), and (Os K x ray)/(Ir K x ray) when produced by Os(n,γ)

R.D.Hill, J.W.Mihelich, Phys. Rev. 89, 323(1953).

15.0^d

τ_2 15^d Os($\leqslant$22-Mev γ) Os(pile n)
β^- ~0.14 sπ
γ_1 50%* 0.0417 E2
γ_2 100%* 0.1291 M1,E2

	K	L_I	L_{II}	L_{III}	M_I	M_{II}	M_{III}	N
γ_1		32	40	—	11	19	9.5	
γ_2	100	30	11	6.0	←—	12	—→	3.5

$[e_L^-(0.129\gamma)][e_L^-(0.042\gamma)]$
*Assuming M1/E2 = 3 for 0.129γ

J.B.Swan, R.D.Hill, Phys. Rev. 88, 831(1952).

Os^{192} 76 116

$\tau_{\beta\beta}$ > 10^{14y} ppl
Assuming decay energy ≥ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Os^{193} 76 117

τ 32^h Os(pile n),
β^- ~1 not Os($\leqslant$22-Mev γ); a
Weak γ's with $14^h < \tau < 15^d$
~0.065 0.215 0.323 0.460

J.B.Swan, R.D.Hill, Phys. Rev. 88, 831(1952).

γ 0.073 L_I/L_{II}~1 0.404 s ce$^-$
0.106 L/M~3 0.460
0.139 K/L~5 0.558
0.251
0.281 K/L~10
0.321 K/L~8

J.M.Cork, J.M.LeBlanc, W.H.Nester, D.W.Martin, M.K.Brice, Phys. Rev. 90, 444(1953).

Os^{193} (76 117) γ 0.280 0.460 0.560 scin

No 1.58γ

B.L.Saraf, J.Varma, C.E.Mandeville, Phys. Rev. 91, 1216 (1953).

Ir — Neutron resonance (ev) 0.654 — cryst s

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 363A (1953).

Ir^{192} (77 115) 1.4^m — γ (0.057) α_L>400 Ir(pile n); pc

Ir L x ray but no unconverted γ found

J.H.Kahn, ORNL-1089 (1951).

70^d — β^- s

β^-	16%	0.24		
	40%	0.54		
	44%	0.67		

No 0.84β^- (<0.4%)

	E	K*	L*	M*
γ	0.137		~1.8	
	0.202	~0.65		
	0.207	4.3	4.0	1.2
	0.296	16	7.4	
	0.309	15	6.7	
	0.317	34	18	5.5
	0.401	~0.1		
	0.420	~0.1		
	0.440	~0.05		
	0.468	7.7	2.2	0.64
	0.488	0.50		
	0.590	0.45	0.07	
	0.605	1.4	0.25	
	0.613	0.56	0.10	
	0.880	4.4**	1.1**	~0.5**

*$(ce^-/\beta) \times 10^{-3}$ **$(ce^-/\beta) \times 10^{-6}$

A.A.Bashilov, N.M.Anton'eva, B.S.Dzhelepov, Izvest. Akad. Nauk Ser. Fiz. SSSR 16, 264 (1952).

γ	0.4†	0.13633	30.0†	0.46798
	1.0†	0.20131	1.1†	0.4848
	7.5†	0.20574	1.1†	0.5884
	38.0†	0.29594	1.4†	0.6045
	37.0†	0.30845	0.5†	0.6129
	99.0†	0.31646		

Os K x ray Pt K x ray Ir(pile n), cryst

Level scheme given

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775 (1952).

γ	2†	0.200	100†	0.467
	3†	0.205	5†	0.486
	50†	0.295	10†	0.589
	50†	0.307	30†	0.606
	100†	0.315		

sl pe$^-$

J.L.Wolfson, Proc. Roy Soc. Canada 44, 193A (1950).

Ir^{194} (77 117) γ scin

γ	100†	0.33	
	100†	1.48	(E)2 98% (M)1 2%
	1†	{1.8, 2.1}	

(1.48γ) (0.33γ) (θ) I = 2,2,0

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

Pt^{191} (78 113) τ 3.2^d Ir(10-Mev d) chem, not Pt($\leqslant$22-Mev γ)

γ	0.062	0.129	0.350 sπ ce$^-$
	0.082	0.171	0.359
	0.094	0.178	0.408
	0.125	0.267	0.455
			0.537

No 0.042γ

J.B.Swan, W.M.Portnoy, R.D.Hill, Phys. Rev. 89, 907A; 90, 257 (1953).

Pt^{193} (78 115) 4.3^d — τ_1 4.5^d Ir(10-Mev d) chem, Pt($\leqslant$22-Mev γ)

γ IT 0.135 M4 sπ

$K : L_I : L_{III} : M : N = 10 : 12 : 24 : 13 : 6$

J.B.Swan, W.M.Portnoy, R.D.Hill, Phys. Rev. 89, 907A; 90, 257 (1953).

$_{78}Pt^{193}_{115}$ g.s. — τ_2 > 74^d or < 1^h

Measurements outside these limits obscured by 72^dIr and 80^mPt

J.B.Swan, W.M.Portnoy, R.D.Hill, Phys. Rev. 90, 257 (1953).

$Pt^{195?}$ (78 117) γ Pt(p,p'γ) E_p = 2.0 0.126 scin

Assignment to Pt^{192} also possible

C.L.McClelland, C.Goodman, Phys. Rev. 91, 760 (1953).

Pt^{198} (78 120) $\tau_{\beta\beta}$ > 10^{15y} ppl

Assuming decay energy $\geqslant$2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911 (1952).

Au — Neutron resonance (ev) 4.93 — cryst s

H.H.Landon, V.L.Sailor, H.L.Foote, Jr., Phys. Rev. 90, 363A (1953).

Neutron resonance 4.85 ev

A.W.Merrison, E.R.Wiblin, Proc. Roy. Soc. 215A, 278 (1952).

$Au^{\geq 183, \leq 187}$ (79) τ 4.3^m Pt(120-Mev p); chem

α 5.1 ic

J.O.Rasmussen, Jr., S.G.Thompson, A.Ghiorso, Phys. Rev. 89, 33 (1953).

Au^{195} (79 116) 30^s — τ 30^s d 38^hHg chem

γ 0.056 0.259 sl ce$^-$

O.Huber, R.Joly, P.Scherrer, N.F.Verster, Helv. Phys. Acta 25, 621 (1952).

γ 0.057 0.262 d 38^hHg; s$\pi\sqrt{2}$

K.Gopalakrishnan, A.de-Shalit, J.W.Mihelich, Phys. Rev. 89, 908A (1953).

Au^{196}
79 117
5.6^{d}

γ (0.33) (E)2 95% (M)1 5% $\gamma\gamma(\theta)$
(0.36) (E)2 $\gamma\gamma(\theta)$
$\gamma\gamma(\theta)$ I = 2,2,0
No crossover γ (< 1%) scin
$\gamma\gamma(\theta)$ independent of phase and chemical structure

R.M.Steffen, Phys. Rev. 89, 665(1953); 89, 903A (1953).

Au^{197}
79 118
7.4^{s}

γ d 23^{h} Hg $s\pi$ ce^-; scin
IT 0.130 $K:L_I:L_{II}:L_{III}:M$ $\alpha_K \leq 2$
10:<2:~54:21:36 E3
0.279 K:L $\alpha_K \sim 0.27$
>60:10 M1

0.191γ, 0.077γ, previously assigned to decay of 23^{h} Hg through 7.4^{s} Au, now assigned to 65^{h} Hg decay. New assignment based on above E3 0.130 γ, now resolved from 0.134γ, and on new threshold for Au(n,n')7.4^{s} Au of <0.42*

J.W.Mihelich, A.de-Shalit, Phys. Rev. 91, 78 (1953); * H.C.Martin, ibid.

Au(n,n')7.4^{s}Au
Threshold 0.42

H.C.Martin, B.C.Diven, R.F.Taschek, Phys. Rev. 92, 1096A (1953).

Au^{197}
79 118

Au(p,p'γ) E_p = 2.0
γ's 0.25? scin
0.45?

C.L.McClelland, C.Goodman, Phys. Rev. 91, 760(1953).

Au^{198}
79 119

τ $2.697^{d} \pm 0.003$ Au(pile n)
Counted for 10 days β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

β^- 0.958 sl
1.370 $\Delta I = 3$, yes

J.L.Wolfson, L.G.Elliott, Proc. Roy. Soc. Canada 46, 142A(1952).

γ 0.411770 ± 0.000036 cryst

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond Phys. Rev. 88, 775(1952).

γ 0.41173 ± 0.00007 $s\pi\sqrt{2}$ ce^-
Compared with 0.51084 Th L line in Tl^{208}

A.Hedgran, D.Lind, Arkiv Fysik 5, 177(1952).

γ 0.411 L_I / L_{III} = 2.5 E2

J.B.Swan, R.D.Hill, Phys. Rev. 91,424(1953).

γ (0.68) (E)2 60% (M)1 40% $\gamma\gamma(\theta)$
(0.68γ) (0.41γ) (θ) I = 2,2,0

D.Schiff, F.R.Metzger, Phys. Rev. 90,849(1953).

γ (0.68) (E)2 60% (M)1 40% $\gamma\gamma(\theta)$
(0.68γ) (0.41γ) (θ) I = 2,2,0

C.D.Schrader, E.B.Nelson, J.A.Jacobs, Phys. Rev. 90, 159(1953).

Au^{198}
79 119

No ϵ_K (<0.5%) sl
from absence of Pt Auger e^-

C.D.Broyles, D.A.Thomas, S.K.Haynes, Phys. Rev. 89, 715(1953).

Au^{200}
79 121

τ 48^{m} Hg^{201} ($\leq$ 28-Mev γ) chem
β^- 2.2 a
γ 0.39 scin
1.13
$\beta/\gamma = 5$

F.D.S.Butement, R.Shillito, Proc. Phys. Soc. 65A, 945(1952).

Au^{201}
79 122

τ 26^{m} Hg^{202} ($\leq$ 28-Mev γ) chem
β^- 1.5 a
γ 0.55 scin
$\beta/\gamma = 20$

F.D.S.Butement, R.Shillito, Proc. Phys. Soc. 65A, 945(1952).

Au^{202} ?
79 123

τ $\sim 25^{s}$ Hg(18-Mev n) chem

F.D.S.Butement, R.Shillito, Proc. Phys. Soc. 65A, 945(1952).

Au^{203}
79 124

τ 55^{s} Hg^{204} ($\leq$ 28-Mev γ) chem
β^- 1.9 a
γ 0.69 scin
$\beta/\gamma = 10$

F.D.S.Butement, R.Shillito, Proc. Phys. Soc. 65A, 945(1952).

Hg

Hg(p,p'γ) E_p = 2.0
γ ~0.20 scin

C.L.McClelland, C.Goodman, Phys. Rev. 91,760(1953).

Neutron resonances (ev) E_n=0.7 to 1500 ev

23.1*	91	311*
33.3*	127	437
42.8	175*	1230
71	204	

* Most prominent

R.R.Palmer, L.M.Bollinger, Phys. Rev. 91, 450A (1953).

Neutron resonances (ev) E_n = 3 ev to 10 kev

	$\sigma_0\Gamma^2$
23.3	9
35.4	170
191	
~350	

E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1952).

Hg^{193}
80 113
10^{h}

γ 0.039 Au(p)chem; $s\pi\sqrt{2}$ ce^-(Hg)
0.102
0.032 $s\pi\sqrt{2}$ ce^-(Au)
0.120
0.258

K.Gopalakrishnan, A.de-Shalit, J.W.Mihelich, Phys. Rev. 89, 908A(1953).

$_{80}Hg^{193}_{113}$ 29^h

τ_2 27^h Au(p) chem

K.Gopalakrishnan, A.de-Shalit, J.W.Mihelich, Phys. Rev. 89, 908A(1953).

Hg^{195} 80 115 38^h

γ 0.037 Au(p) chem; $s\pi\sqrt{2}$ ce^-
0.123

K.Gopalakrishnan, A.de-Shalit, J.W.Mihelich, Phys. Rev. 89, 908A(1953).

γ 0.036 Au(25-Mev d) chem
γ IT 0.122 sl ce^-

O.Huber, R.Joly, P.Scherrer, N.F.Verster, Helv. Phys. Acta 25, 621(1952).

9.5^h

τ_2 9.5^h Au(25-Mev d) chem
γ 0.061 sl ce^-
ce^- 0.099

O.Huber, R.Joly, P.Scherrer, N.F.Verster, Helv. Phys. Acta 25, 621 (1952).

Hg^{197} 80 117 23^h

γ Au^{197}(p,n) $s\pi$ ce^-
$L_I : L_{II} : L_{III}$
0.134 0.4:11:10 E2
0.165 10 :<1:15 M4

65^h

0.0774* 100:45:34 M1+E2
0.191* K/L=6

* Previously assigned to 7.4^s Au, q.v.

J.W.Mihelich, A.de-Shalit, Phys. Rev. 91,78(1953)

Hg^{198} 80 118

Level Hg(γ,γ') E_γ = 0.411
(0.411) $\tau \sim 1.1 \times 10^{-11}$*
Source heated to compensate for recoil
*With statistical weight factor S = 1 in
σ(abs. of 0.411γ) = kSΓf(temp)

K.G.Malmfors, Arkiv Fysik 6, 49 (1953).

Level Hg(γ,γ') E_γ = 0.411
(0.411) $\tau \sim 8 \times 10^{-11s}$*
Source rotated to compensate for recoil
*With statistical weight factor S = 5 in
σ(abs. of 0.411γ) = kSΓf(velocity)

P.B.Moon, A.Storruste, Proc. Phys. Soc. 66A, 585 (1953).

Hg^{199} 80 119 43^m

γ 0.159 L_{II} / L_{III} = 1.6 E2

J.B.Swan, R.D.Hill. Phys. Rev. 91, 424 (1953).

Hg^{200} 80 120

Capture γ Hg(n,γ) $s\pi$ ce^-
~0.28

C.T.Hibdon, C.O.Muehlhause, Phys. Rev. 88, 943 (1952); 87, 222A(1952).

Hg^{203} 80 123

γ (0.28) $\tau < 2 \times 10^{-9s}$ $\beta\gamma$

T.C.Engelder, Phys. Rev. 90, 259(1953).

γ (0.28) M1 + E2
$L_I : L_{II} : L_{III}$ = 2.85: 2.08: 1.0

J.B.Swan, R.D.Hill, Phys. Rev. 91, 424 (1953).

Tl

Tl(p,p'γ) E_p = 2.0
γ 0.38 scin

C.L.McClelland, C.Goodman, Phys. Rev. 91, 760 (1953).

Tl^{198} 81 117 1.8^h

τ_1 ~2^h Hg(10-Mev d)
γ 0.260 M4 s ce^-
0.282 M1

I.Bergström, R.D.Hill, Phys. Rev. 92, 849A (1953).

4^h

τ_2 4^h Hg(10-Mev d)
γ 0.411
0.675

I.Bergström, R.D.Hill, Phys. Rev. 92, 849A (1953).

Tl^{203} 81 122

$\mu(Tl^{203})/\mu(Tl^{205})$ = 0.990258 I
± 0.000001
Resonance frequencies depend on anions in solution; shifts same for Tl^{203},Tl^{205}

H.S.Gutowsky, B.R.Garvey, Phys. Rev. 91, 81(1953).

Tl^{204} 81 123

τ $4.02^y \pm 0.12$ Tl(n,γ) chem
Counted over period of 2.9 y. after cooling 2.7 y

G.Harbottle, Phys. Rev. 91, 1234 (1953).

τ $2.71^y \pm 0.05$ Tl(pile n)
Counted for 8 months β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

β^- 98.5% 0.760 ΔI = 2, yes shape 4πscin
ϵ ~1.5%

$E_{dis}(\epsilon)$ ~0.4 (calc)
No 0.37γ (< 10^{-2}%)

E.der Mateosian, A.Smith, Phys. Rev. 88, 1186 (1952).

Tl^{206} 81 125

τ $4.19^m \pm 0.02$ Tl(pile n)
Counted for 25 half-lives β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Tl^{207} 81 126

τ $4.79^m \pm 0.02$ Bi^{211} recoil
Counted for 25 half-lives β electroscope

B.W.Sargent, L.Yaffe, A.P.Gray, Can. J. Phys. 31, 235(1953).

Tl^{208} 81 127

γ 0.05† 0.27735 Th^{228}source, cryst
0.15† 0.5108
0.40† 0.5830
0.24098γ (0.10†) unassigned
† Relative to 0.238γ of Pb^{212}

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775(1952).

γ (2.62) $\alpha_{pair} = 4.3 \times 10^{-4}$ E2 s

H.Slätis, K.Siegbahn, Arkiv Fysik 4, 485(1952).

Tl^{208} 81 127

No 5.1 β (<0.2%)

P.E. Cavanagh, quoted by P.Marin, G.R.Bishop, H. Halban, Proc. Phys. Soc. 66A, 608 (1953).

(0.58γ) (2.62γ) polarization-direction
I = 4+, 2+, 0+

J.J.Kraushaar, M.Goldhaber, Phys. Rev. 89, 1081 (1953).

Tl^{209} 81 128

β⁻ 1.99 d 10^d Ac; s

F.Wagner, Jr., M.S.Freedman, D.W.Engelkemeir, L.B.Magnusson, Phys. Rev. 88, 171A(1952).

Pb

Variations in relative isotopic abundances

C.B.Collins, R.M.Farquhar, R.D.Russell, Phys. Rev. 88, 1275(1952).

Pb(p,p) E_p = 1.8
No γ observed scin

T.Huus, Č.Zupančič, Kgl. Danskab. Sekskab, Mat-fys. Medd. 28, No. 1 (1953).

Level Pb(n,n′γ) E_n = 3.7 scin
γ 2.65

M.A.Rothman, D.W.Kent, C.E.Mandeville, Phys. Rev. 92, 1097A(1953); J.Franklin Inst. 256, 278 (1953).

Pb^{200} 82 118

γ 0.139 Tl(60-Mev d) chem
0.320 sπ√2 ce⁻

G.D.O'Kelley, UCRL-1243(1951).

Pb^{201} ? 82 119 50^s

τ_1 50^s Tl(p) chem, not Hg(p)
γ ~1† 0.25 scin
~1† 0.42
~4† 0.67

N.J.Hopkins, Phys. Rev. 88, 680(1952).

Pb^{202} ? 82 120 5.6^s

τ_1 5.6^s Tl(p), not Hg(p)
γ 0.89 scin

N.J.Hopkins, Phys. Rev. 88, 680(1952).

Pb^{203} 82 121

γ 0.153 Tl(60-Mev d) chem
0.269 K/L = 2.3 sπ√2 ce⁻
0.424

G.D.O'Kelley, UCRL-1243(1951).

Pb^{205} 82 123

Levels Pb^{206}(d,t) E_d = 14 a pc
0.3
0.8
1.8

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{206} 82 124

Levels Pb^{207}(d,t) E_d = 14 a pc
0.9 2.2
1.4 3.0
1.7

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{207} 82 125 0.8^s

τ_1 0.80^s

N.J.Hopkins, Phys. Rev. 88, 680(1952).

τ_1 0.9^s d 50^y Bi chem

G. Friedlander, E.Wilson, A.Ghiorso, I.Perlman, Phys. Rev. 91, 498A (1953).

Pb^{207} 82 125

Levels	Pb^{206}(d,p)	Pb^{208}(d,t)
	0.6	0.6
	1.0	1.0
	2.8	1.6
	3.6	2.3
	4.4	
	4.7	
	5.3	E_d = 14 a pc

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{208} 82 126

Levels Pb^{207}(d,p) E_d = 14 a pc
3.4 5.4
3.6 6.1
5.1

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{209} 82 127

β⁻ 0.63 d 10^d Ac chem; s, scin

F.Wagner, Jr., M.S.Freedman, D.W.Engelkemeir, L.B.Magnusson, Phys. Rev. 88, 171A(1952).

Levels Pb^{208}(d,p) E_d = 14 a pc
0.8 2.0
1.6 2.5

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Pb^{210} 82 128

β⁻ 0.015 pc
No nuclear 0.0078γ (Cu x ray?)

A.A.Jaffe, S.G.Cohen, Phys. Rev. 89, 454(1953).

β⁻ 0.024 pc
F-K plot linear to 8.5 kev

E.Huster, Naturwiss. 40, 197(1953).

γ (0.047) L : M : N = 100 : 23 : 6 EA
ce⁻ 0.0110 not assigned
No ce⁻(0.014-0.030) <1% of ce_L^-(0.0467γ)

Y.Kobayaski, G.Miyamoto, J. Phys. Soc. Japan 8, 135(1953); 273(1953).

γ 7† 0.0465 α = 12 pc sπ
L_I : L_{II} : L_{III} : M : NO
100: 7.5: 0.7: 26: 7.7 M1
No other γ (< 0.5 %)
†Photons per 100 disintegrations

C.S.Wu, F.Boehm, E. Nagel, Phys. Rev. 91, 319; 90, 388A(1953).

γ 0.04652 cryst
No other γ's from 0.016 to 0.062 (< 2%)

G.T.Ewan, M.A.S.Ross, Nature 170, 760(1952).

Pb^{210} 82 128

$(L\ x\ ray)/(0.047\gamma) = 6.3$ pc

Peaks seen ascribed to nuclear γ's of 16.1, 24, 30.7, 37.0, 41.5, 62.5 kev

P.E.Damon, R.R.Edwards, Phys. Rev. 90, 280(1953).

Pb^{212} 82 130

τ $10.64^h \pm 0.03$

Measured for 3 half-lives with ic

P. Marin, G.E.Bishop, H.Halban, Proc. Phys. Soc. 66A, 608 (1953).

τ 10.67^h

H.Buttar, Naturwiss. 39, 575(1952).

γ 0.23860 cryst

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775(1952).

γ 0.23863 s

$H\rho(F) = 1388.56 \pm 0.21$

H determined (2-20 kev) with e^- accelerated through known potential

D.I.Meyer, F.H.Schmidt, Phys. Rev. 89, 908A (1953).

γ (0.238) $\tau < 2 \times 10^{-11s}$ βe_K^-

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

Pb^{214} 82 132

β^-		0.35 ?	s βe^-
	33 †	0.67	
	100 †	~0.73	
γ	4.3*	0.241	s ce^-
	4.8*	0.294	
	3.5*	0.350	

$[0.67\beta]\ [e_K(0.35\gamma)]$

$[0.73\beta]\ [e_K(0.29\gamma)]$

*ce^- per 100 β^-

E.E.Berlovich, Izvest. Akad. Nauk Ser. Fiz. SSSR 16, 314(1952).

γ		0.053226	Rn^{222} source, cryst
	20 +	0.24192	
	55 +	0.29522	
	100 +	0.35199	

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775(1952).

γ 0.292 sl pe⁻
0.350

R.M.Pearce, K.C.Mann, Can. J.Phys. 31,592(1953).

Bi^{208} 83 125

Bi(d,t) $E_d = 14$ a pc

Q values −1.17 (g.s. value?)
−1.8
−2.2

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Bi^{209} 83 126

μ 4.0400 $Bi(NO_3)_3$, D_2O; I

$\nu(Bi^{209})/\nu(D) = 1.04684 \pm 0.00005$

Y.Ting, D.Williams, Phys. Rev. 89, 595(1953).

Bi^{209} 83 126

τ 2×10^{17y} ppl

α 2.9

7 α tracks, $E_\alpha = 2.9$, in Bi impregnated plate kept 100 days in N_2, 18°C

W.Riezler, W.Porschen, Z. Naturforsch. 7a, 634 (1952).

Very few low energy α's in Bi loaded plate τ of 2×10^{17y}, E_α of 3 Mev not confirmed

E.P.Hincks, C.H.Millar, Proc. Roy. Soc. Canada 46, 143A(1952).

Bi^{210} 83 127 4.9^d

τ_2 $4.989^d \pm 0.013$ Bi(pile n)

Counted for 33 days β electroscope

E.E.Lockett, R.H.Thomas, Nucleonics 11, No. 3, 14(1953).

Bi^{210} 83 127

β spectrum shape from $E_\beta = 0.005$ to 0.10 sl

Number β's does not approach 0 as $E_\beta \longrightarrow 0$

J.Pniewski, Acta Phys. Polon. 11, 215(1953);Nature 171, 694 (1953).

No 0.080γ ($<0.02\%$ of β's) scin

D.G.E.Martin, G.Parry, Phil. Mag. 44, 344(1953).

Bi^{210} 83 127 4.9^d

No ce^-, no nuclear γ pc sπ

C.S.Wu, F.Boehm, E.Nagel, Phys. Rev. 91,319; 90, 388A(1953).

Continuous γ spectrum scin

$\gamma(E_\gamma > 0.09)/\beta^- = 0.00084$

P.Bolgiano, L.Madansky, F.Rasetti, Phys. Rev. 89, 679(1953).

Bi(d,p) $E_d = 15$ scin

Q value 1.94

No higher energy p group ($<3\%$ of Q = 1.94 group) but believed not g.s. Q

N.S.Wall, Phys. Rev. 91,485A(1953).

Bi(d,p) $E_d = 14$ a pc

Q values 1.94 −0.3
0.30 −0.8

J.A.Harvey, Can. J. Phys. 31, 278(1953).

Bi^{211} 83 128

γ (0.35) $\tau < 1.2 \times 10^{-9s}$ α ce^-

$(6.272\alpha)(0.35\gamma)(\theta)$ isotropic

S.Gorodetzky, A.Gallman, A.Knipper, R.Armbruster, Compt. rend. 237, 245 (1953).

Bi^{212} 83 129

α 6.051* s
6.090

*Value of 6.046 (Nature 167, 682) in error

E.R.Collins, C.D.McKenzie, C.A.Ramm, Proc. Roy. Soc. 216A, 219(1953).

α 35.4% ic

β^- 64.6%

P.Marin, G.R.Bishop, H.Halban, Proc. Phys. Soc. 66A, 608 (1953).

Bi^{212} 83 129

γ (0.040) $\tau < 7 \times 10^{-11s}$ αe_L

R.L.Graham, R.E.Bell, Can. J. Phys. 31, 377(1953).

γ 0.15† 0.729 Th^{228} source, cryst
†Relative to 0.238γ of Pb^{212}

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775(1952).

(6.04α) (0.04γ) (θ) b=1.30 I= 1,3,4 or 1,4,5

J.Horton, R.Sherr, Phys. Rev. 90,388A(1953).

Bi^{213} 83 130

β^- 0.96 d 10^dAc chem; s
1.39
γ 0.120
0.435
(1.39β) (0.12γ)

F.Wagner, Jr., M.S.Freedman, D.W.Engelkemeir, L.B.Magnusson, Phys. Rev. 88, 171A(1952).

Bi^{214} 83 131

β^- 81% ~1.55 Ra^{226} source a$\beta\gamma$
<10% (2.56) a
19% (3.17) a
E_{dis} = 3.17

A.H.Wapstra, Physica 18, 1247(1952).

γ 0.452 0.932 1.750
0.500 1.123 1.800
0.607 1.236 2.192
0.783 1.400
0.860 1.525 sl pe^-

R.M.Pearce, K.C.Mann, Can. J. Phys. 31,592(1953).

γ 1.6† 0.6094 Rn^{222} source, cryst
†Relative to 0.352γ of Pb^{214}

D.E.Muller, H.C.Hoyt, D.J.Klein, J.W.M.DuMond, Phys. Rev. 88, 775(1952).

γ 0.605 1.379 sπ Cpt line
0.699* 1.504* 1.832*
0.770 1.627** 2.116**
0.907 1.679** (2.193)
(1.120) 1.727** 2.42**
1.247 (1.761)
( ) Used as standards
* ce_K^- seen by Ellis but assigned otherwise
** ce^- seen by Ellis but not assigned

M.Mladjenović, A.Hedgran, Physica 18, 1242(1952).

γ 1.1205 sπ ce_K^-
1.4158
H_ρ = 4939.8 ± 0.8, 5874.4 ± 0.6 gauss cm

G.Lindström, A.Hedgran, D.E.Alburger, Phys. Rev. 89, 1303(1953).

$\gamma\gamma(\theta)$ b ~0.3

F.Demichelis, R.Malvano, Nuovo Cimento 9, 1106 (1952).

Bi^{215} 83 132

τ 8^m d $0.9^m At^{219}$ p $2^{ms} Po^{215}$

E.K.Hyde, A.Ghiorso, Phys. Rev. 90, 267(1953).

Po^{206} 84 122

α 5% d $2.3^h Rn^{210}$

F.F.Momyer, UCRL-2060(1953).

Po^{210} 84 126

τ 138.39^d ± 0.14
Observed for 200 days calorimeter

D.C.Ginnings, A.F.Ball, D.T.Vier, J. Research Nat. Bur. Standards 50, 75(1953); J. Franklin Inst. 255, 241(1953).

Po^{211} 84 127

Not parent 0.8^s Pb (< 0.003%) chem

G.Friedlander, E.Wilson, A.Ghiorso, I.Perlman, Phys. Rev. 91, 498A (1953).

Po^{212} 84 128

τ 2.9×10^{-7s} $\beta\gamma$

T.Hayaski, Y.Ishizaki, I.Kumabe, J. Phys. Soc. Japan 8, 110(1953).

Po^{214} 84 130

τ 1.58×10^{-4s} $\beta\alpha$

R.Ballini, Ann. Phys. 8, 441 (1953).

Po^{218} 84 134

α 5.996 s

G.Bastin-Scoffier, J. Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

β^- 0.022% ic

F.Hiessberger, B.Karlik, Sitzber. Akad. Wiss. Wien, Math-naturw. Kl. Abt. II a 161, 51 (1952).

At^{211} 85 126

α 5.862

R.W.Hoff, F.Asaro, quoted by F.F.Momyer, UCRL-2060(1953).

At^{219} 85 134

τ 0.9^m d $21^m Fr^{223}$ chem
α 6.27 ic
α/β^- = 30

E.K.Hyde, A.Ghiorso, Phys. Rev. 90, 267(1953).

Rn^{208} 86 122

τ 23^m p $4^h Po^{204}$ Th(340-Mev p)
ϵ ~80%
α ~20% 6.138 s

F.F.Momyer, UCRL-2060(1953).

Rn^{209} 86 123

τ 30^m p $5.7^h At^{209}$ Th(340-Mev p)
ϵ ~85%
α ~15% 6.04 s

F.F.Momyer, UCRL-2060(1953).

Rn^{210} 86 124

τ 2.7^h p $9^d Po^{206}$ Th(340-Mev p)
ϵ <5%
α >95% 6.036 s

F.F.Momyer, UCRL-2060(1953).

Rn^{211} 86 125

τ 16^h Th(340-Mev p)
ϵ 74%
α 17% 5.778 s
9% 5.847
γ 0.07 scin
0.15
0.40
0.60

F.F.Momyer, UCRL-2060(1953).

Rn^{212} 86 126

α 6.262 Th(340-Mev p) s

F.F.Momyer, UCRL-2060(1953).

Rn^{220} 86 134

α 6.278 s

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Rn^{221} 86 135

τ 25^{m} Th(110-Mev p)
β^- ~80%
α ~20%

F.F.Momyer, UCRL-2060(1953).

Rn^{222} 86 136

α 5.482 s

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Fr^{212} 87 125

α	24%	6.339	s
	39%	6.387	
	37%	6.409	

E.K.Hyde, F.Asaro, quoted by F.F.Momyer, UCRL-2060(1953).

Fr^{223} 87 136

α/β^- $\sim 4 \times 10^{-5}$

E.K.Hyde, A.Ghiorso, Phys. Rev. 90, 267(1953).

Ra^{213} 88 125

τ 2.7^{m} p $30^{m}Rn^{209}$ $Pb(C^{12})$
α 6.90 ic

F.F.Momyer, UCRL-2060(1953).

Ra^{223} 88 135

τ 11.1^{d} Rn^{222}(pile n,$\gamma\beta\beta$) chem

A.P Baerg, Phys. Rev. 90, 1121 (1953).

Ra^{224} 88 136

α 5.679 s

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

Ra^{226} 88 138

α 5.7% (4.611) s, ppl
No α's from 3.6 to 4.4 (<0.02%)* ic

F.Asaro, I.Perlman, Phys. Rev. 88, 129(1952).
*A.Ghiorso, ibid.

α 4.777 ± 0.004 s
Based on E_{α}(Po) = 5.299

G.Bastin-Scoffier, J.Sant'ana-Dionisio, Compt. rend. 236, 1016(1953).

γ (0.186) α = 0.9* E2 αe^-
*Assuming 4.611α in 6.4% of disintegrations

C.Victor, J.Teillac, P.Falk-Vairant, G.Bousseres, J. phys. radium 13, 565(1952).

Ra^{227} 88 139

τ		41.2^{m}	Ra^{226}(n,γ)chem
β^-		1.31	a
γ	4.0†	0.291	scin
	0.6†	0.498	
x	3.1†	K x ray	

†Photons per 100 β^-

J.P.Butler, J.S Adam, Phys. Rev. 91, 1219 (1953).

Ac^{228} 89 139

β^-	13%	0.45		d Ra^{228} chem	sπ $\beta\gamma$
	8%	0.64			
	53%	1.11			
	7%	1.70			sπ
	9%	1.85			
	10%	2.18			
γ		0.0567			sπ ce$^-$
		0.078			
		0.0978	0.232	0.965	
		0.113	0.336	1.035	
		0.1275	0.410	1.095	
		0.179	0.458	1.587	
		0.184	0.907	1.640	

(0.45β,0.64β) (>1.1γ) (1.11β) (~1γ)
(1.70β,1.85β) (>0.9γ) No (2.18β) (γ)
(0.098 ce_L^-,0.127 ce_L^-, 0.184 ce_L^-) (γ)
No (0.127 ce$^-$) (0.184 ce$^-$) No (>0.9γ) (>0.9γ)
(~0.45γ) (~1.0γ) (~0.9γ) (<0.4γ)
No (~0.45γ) (>1.1γ)
No β(soft e$^-$) delay observed; implies $500^{\mu s} > \tau(0.057\gamma) > 0.1^{\mu s}$ or $>0.01^{s}$

J.Kyles, C.G.Campbell, W.J.Henderson, Proc. Phys. Soc. 66A, 519 (1953).

Th

Neutron resonances (ev) E_n = 2 ev to 2 kev
25 $\sigma_o \Gamma^2$ = 64
80
170

E.R.Hodgson, J.F.Gallagher, E.M.Bowey, Proc. Phys. Soc. 65A, 992(1952).

Th^{228} 90 138

α	0.2%	5.173		s
	0.4%	5.208		
	28 %	5.388		
	71 %	5.421		
γ		0.089	α ~ 16	scin
		0.137	α << 1	
		0.169	α ~ 1.2	
		0.212	α << 1	

F.Asaro, F.Stephens, Jr., I.Perlman, UCRL-2244(1953).

γ (0.084) α = 12* E2 αe^-
*Based on γ/α = 0.02**

C.Victor, J.Teillac, P.Falk-Vairant, G.Boussieres, J. phys. radium 13, 565(1952); **M.Riou, ibid.

γ	100†	(0.084)	Th^{228} extracted from Ra^{228}
	14†	0.133	
	10†	0.172	
	17†	0.216	scin

Decay products continuously removed

G.Boulssieres, P.Falk-Vairant, M.Riou, J.Teillac, C.Victor, Compt. remd 236, 1874 (1953).

(α) (0.083γ) (θ) does not agree with I = 0, I, 0
$\tau(0.083\gamma) < 10^{-8s}$ Source $Th(OH)_4$
No (0.0868γ) (α) No $\gamma\gamma$

J.Battey, L.Madansky, F.Rasetti, Phys. Rev. 89, 182(1953).

Th^{230} 90 140

γ	33†	(0.067)	9% Th^{230} scin
	4†	0.150	
	~0.3†	0.207	

Th^{230}
90 140

	1†	0.254		
x	660†	L x ray		

†Photons per 10^4 disintegrations

G.Bouissieres, P.Falk-Vairant, M.Riou, J.Teillac, C.Victor, Compt. rend. 236, 1874 (1953).

γ	105†	0.068	$\tau < 0.3^{\mu s}$	10% Th^{230}
	14†	0.142		scin
	5†	0.255		
x	1170†	L x ray		

$(0.14\gamma)(0.068\gamma)$ No (0.068γ) (L x ray)
No $(0.25\gamma)(0.068\gamma)$ No $(0.25\gamma)(0.14\gamma)$
†Photons per 10^4 disintegrations

F.Rasetti, E.C.Booth, Phys. Rev. 91, 315; 90,388A (1953).

γ (0.070) L/M = 12 cc
$ce^-/\alpha = 0.17$
$(\alpha)(ce_L^-)(\theta)$ graph

R.R.Roy, M.L.Goes, Nature 172, 360 (1953).

α	~0.03%	4.44	~100% Th^{230} ms
	~0.12%	4.47	ic
	(25%)	(4.612)	
	(75%)	(4.682)	

$(4.47\alpha)(ce^-)$ $(4.61\alpha)(ce^-)$
No $(4.44\alpha)(ce^-)$ No $(4.68\alpha)(ce^-)$

G.Valladas, R.Bernas, Compt. rend. 236, 2230 (1953).

$(\alpha)(0.068\gamma)(\theta)$ I = 0, 2, 0 scin

G.M.Temmer, J.M.Wyckoff, Phys. Rev. 92, 849A (1953).

Th^{232}
90 142

γ 0.075 ppl
$e^-/\alpha = 0.2$

G.Albouy, J. phys. radium 13, 309 (1952).

Th^{234}
90 144

β^-	33%	0.103	Th^{234} + Pa^{234} source
	67%	0.193	$s\overline{N}2$
γ		0.0294	- $s\overline{N}2$ ce^-
		0.0431	
		0.0471?	
		0.0630	
		0.0914	$L_I:M_I:N_I$ = 83:21:5.7
		0.1002	

$[ce^-_{L_I}(0.091\gamma)]/\beta = 0.083$
γ's could belong to Pa^{234}

P.H.Stoker, M. Heerschap, O.P.Hok, Physica 19, 433 (1953).

Pa^{231}
91 140

γ (0.027) τ=4.2x10^{-8s} $\alpha\gamma$
$\alpha_L \sim 7$ E1 a

J.Teillac, M. Riou, P. Desneiges, Compt. rend. 237, 41 (1953).

γ	0.0273	$\alpha < 10$	E1 a
	0.0336		ce^-, ppl
	0.0380		
	0.0569	$L_I + L_{II} \simeq L_{III}$	E2
	0.0635		

Pa^{231}
91 140

0.0823	$L_I \simeq M_I$	
	Rel. intensity of ce^-	
0.102	$L_{II}:L_{III}:M$ = 2:2:2	
0.198	K : L = 2:5	
0.259	K : L = 10:5	
0.301	K : L : M=100:20:7	
	$\alpha_K \sim 1.6$	M1
0.331	K : L : M=50:10:1	
	$\alpha_K \sim 1.6$	M1
0.357	K : L = 10:2	
0.383	K = 5	

Unassigned ce^- 0.125, 0.135, 0.170

P.Falk-Vairant, M.Riou, J. Phys. Radium 14, 65 (1953); P. Falk-Vairant, Compt. rend. 235, 796 (1952).

γ 0.044 cc
0.066

J.Teillac, Ann. Phys. 7, 396 (1952).

Pa^{234}
91 143
1.14^m

τ_1 1.175^m

F.Barendregt, Sj.Tom, Physica 17, 817 (1951).

β^-	1%	0.580	Th^{234}+Pa^{234} source
	9%	1.500	$s\overline{N}2$
	90%	2.305	
γ		0.229	converted in Pa
		0.316	
		0.810	α_K~0.06 K/L = 5.2
		0.845	
		0.877	

No 0.395γ $(ce^-_{LM}/\beta^- < 3x10^{-4})$
See Th^{234} for possible γ's

P.H.Stoker, M.Heerschap, O.P.Hok, Physica 19, 433 (1953).

6.7^h

β^-	~75%	~0.50	U chem	sl
	~18%	0.90*		
	~ 7%	1.35*		
		0.104? 0.276		sl ce^-
		0.126? 0.60		
		0.160? 0.76		
		0.230 0.86		

*Could be single spectrum of 0.98 (25%)

G.Bouissieres, N.Marty, J.Teillac, Compt. rend. 237, 324 (1953).

U

Neutron resonances (ev) E_n = 3.7 to 800 ev

6.6	σ_0 = 5000 Γ = 0.05
20	$\sigma_0\Gamma^2$ = 4.5
38	$\sigma_0\Gamma^2$ = 6.5

E.Hellstrand, R.Persson, Arkiv Fysik 6, 57 (1953).

U^{233}
92 141

γ 5† 0.0428 pc
1† 0.0561
(L x ray)/α = 0.04
†Photons per 10^4 α's

D.West, J.K.Dawson, C.J.Mandleberg, Phil. Mag. 43, 875 (1952).

$_{92}U^{233}_{141}$

γ_1 ~0.040 ppl
γ_2 (0.056)
γ_3 (0.099)
$\alpha + e_1^-$, $\alpha + e_1^- + e_2^-$, $\alpha + e_3^-$ tracks
$(\alpha + e_1^-)/(\alpha + e_1^- + e_2^-) \sim 70$ $(\alpha + e^-)/\alpha = 0.09$

K.M.Bisgård, Proc. Phys. Soc. 65A, 677(1952).

$U^{234}_{92\ 142}$

τ $2.475 \times 10^{5\,y}$ ± 0.016 chem, ms; ic 95.99% U^{234}

E.H.Fleming, Jr., A.Ghiorso, B.B.Cunningham, Phys. Rev. 88, 642(1952).

$U^{235}_{92\ 143}$

τ $7.13 \times 10^{8\,y}$ ± 0.16 chem, ms; ic 99.94% U^{235}

E.H.Fleming, Jr., A.Ghiorso, B.B.Cunningham, Phys. Rev. 88, 642(1952).

$U^{236}_{92\ 144}$

τ $2.391 \times 10^{7\,y}$ ± 0.018 chem, ms; ic 96.65% U^{236}

E.H.Fleming, Jr., A.Ghiorso, B.B.Cunningham, Phys. Rev. 88, 642(1952).

$U^{237}_{92\ 145}$

τ		6.75^d	U^{236} (pile n) chem
β^-	< 20%	(0.080)	sl, scin $\beta\gamma$
	> 80%	0.25	
γ		0.027	
		0.043	sl ce$^-$
	37†	0.059	
		0.165	$K/L_1 < 0.2$
	21†	0.207	$K/L_1 = 4.8$
		0.269	
	2.5†	0.334	
		0.370	
		0.430	

$(0.21\gamma)(0.027\gamma)$ $(0.21\gamma)(0.06\gamma)$ $(0.21\gamma)(0.17\gamma)$
$(0.25\beta)(0.21\gamma)$
No $(0.33\gamma)(\gamma)$ No 0.51β (< 0.1%)
No photon with $E_\gamma > 0.34$ (< 10% of 0.33γ)

F.Wagner, Jr., M.S.Freedman, D.W.Engelkemeir, J.R.Huizenga, Phys. Rev. 89, 502(1953).

$U^{239}_{92\ 147}$

γ 0.074 $\alpha_L = 0.20$ U(pile n); pc

J.H.Kahn, ORNL-1089(1951).

$U^{240}_{92\ 148}$

τ 14.1^h $U^{238}(n,\gamma)U^{239}(n,\gamma)U^{240}$
β^- 0.36 chem; sl
No γ with $E_\gamma >$ 0.02 scin

J.D.Knight, M.E.Bunker, B.Warren, J.W.Starner, Phys. Rev. 91, 889 (1953).

$Np^{234}_{93\ 141}$

γ 0.177 U^{235}(14-Mev d) chem
0.442 $s\pi\sqrt{2}$ ce$^-$
0.803
1.42

G.D.O'Kelley, UCRL-1243(1951).

$Np^{240}_{93\ 147}$

τ		7.3^m	d 14^hU chem
β^-	6%	0.76	sl
	11%	1.26	
	31%	1.59	
	52%	2.16	

$_{93}Np^{240}_{147}$

γ 63† 0.56 scin
28† 0.90
10† 1.40

J.D.Knight, M.E.Bunker, B.Warren, J.W.Starner, Phys. Rev. 91, 889 (1953).

$Pu^{238}_{94\ 144}$

τ 89.6^y

A.H.Jaffey, J.Lerner, ANL-4411(1950).

γ 6† 0.013 a
11† 0.018
0.4† 0.042
~0.17
†Photons per 10^2 α's

G.W.Reed, Jr., AECD-3185(1947); NSA 5-5421(1951).

γ 0.0450 pc

D.West, J.K.Dawson, C.J.Mandleberg, Phil. Mag. 43, 875(1952).

γ 0.0451 $s\pi\sqrt{2}$ ce$^-$
vw 0.048 ?
Pu from long n irradiation of Am^{241}

G.D.O'Kelley, UCRL-1243(1951).

α 11% 5.100 s
20% 5.137
69% 5.150
No other α's from 4.82 to 5.57 Mev (< 0.3%)

F.Asaro, I.Perlman, Phys. Rev. 88, 828(1952).

$Pu^{239}_{94\ 145}$

γ 2† 0.0385 pc
7† 0.0520
(K x ray)/α = ~2×10^{-5} (L x ray)/α = 0.04
†Photons per 10^5 α's

D.West, J.K.Dawson, C.J.Mandleberg, Phil. Mag. 43, 875(1952).

γ	40+	0.039	pc
	140+	0.053	sl ce$^-$, pc
	110+	0.100	scin
	50+	0.124	scin
	30+	0.384	scin

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

U L x ray/α = 3×10^{-2} pc

H.Israel, Phys. Rev. 88, 682(1952).

$Pu^{240}_{94\ 146}$

α 24% 5.118 Pu(pile n) ms; s
76% 5.162

F.Asaro, I.Perlman, Phys. Rev. 88, 828(1952).

γ 0.050 Pu^{239}(pile n); sl ce$^-$

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

$Pu^{241}_{94\ 147}$

τ_{β^-} 13.0^y
From Am^{241} present 2.39 years after initial purification

D.R.MacKenzie, M.Lounsbury, A.W.Boyd, Phys. Rev. 90, 327(1953).

Pu^{241}
94 147

β^-		0.0205	Pu^{240}(pile n); sl	
γ	100^+	0.100	(K x ray?)	scin
	20^+	0.145		

$^+$Photons per 10^7 β's

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

Pu^{243}
94 149

τ		4.98^h	Pu^{242}(pile n) ion chem	
β^-	12%	($\sim$0.37)		
	35%	0.468		scin
	53%	0.57		
γ		0.085	$\alpha_L \leqslant 0.7$	scin
		$\sim$0.1	$\alpha_L > 10$	

(0.47β)(0.085γ) (0.085γ)($\sim$0.1γ) (0.085γ)(L x rays)
No (0.57β^-) (0.085γ) No (0.57β^-) (L x rays)

D.W.Engelkemeir, P.R.Fields, J.R.Huizenga, Phys. Rev. 90, 6(1953).

Am^{241}
95 146

I	5/2	S

Large q indicated

M.Fred, F.S.Thomkins, Phys. Rev. 89, 318(1953).

γ	25^+	0.0264	Pu^{240}(pile n,$\gamma\beta^-$); pc	
		0.041		sl ce^-
	100^+	0.059		sl ce^-, pc

M.S.Freedman, F.Wagner, Jr., D.W.Engelkemeir, Phys. Rev. 88, 1155(1952).

γ	0.059	$s\pi\sqrt{2}$ ce^-

$[e_L^-(0.059\gamma)]/\alpha = 0.28$

G.D.O'Kelley, UCRL-1243(1951).

γ	0.0603	d 10^yPu; pc

D.West, J.K.Dawson, C.J.Mandleberg, Phil. Mag. 43, 875(1952).

No 0.0334γ, 0.0380γ (<0.1% of 0.0597γ) pc
Suggest lines seen* at 0.014, 0.019, 0.022 due to Am x rays, those at 0.033, 0.038 to La x rays

J.O.Newton, B.Rose, Phys. Rev. 89, 1157(1953).
*C.I.Browne, UCRL-1764(1952); F.Asaro, et al., Phys. Rev. 87, 277(1952).

Am^{242}
95 147
16^h

β^-	70%	0.628		$s\pi\sqrt{2}$
ϵ	15%		Am^{241}(pile n)	chem
γ IT	15%	0.035	$\alpha = 0.25$	$s\pi\sqrt{2}$ Am ce^-
		0.038	$\alpha = 0.25$	Pu ce^-
		0.053	$\alpha = 0.67$	Cm ce^-

L_{III}/L_{II} x ray ratios: Am 4.9, Pu 1.3, Cm 1.0 — cryst

No γ with $E_\gamma > 0.06$ a

G.D.O'Kelley, UCRL-1243(1951).

100^y

β^-	0.593	Am^{241}(pile n)	chem
γ	0.038		$s\pi\sqrt{2}$ Pu ce^-
	0.053		Cm ce^-

G.D.O'Kelley, UCRL-1243(1951).

Cm^{242}
96 146

γ	0.043	$\alpha_L = 0.8$	$s\pi\sqrt{2}$ ce^-

G.D.O'Kelley, UCRL-1243(1951).

NEUTRON CROSS SECTIONS

Absorption cross sections for neutron energies marked "th" (thermal) have been determined, from measurements in a thermal neutron flux, in terms of the cross section value of a "standard" for neutrons of velocity 2200 m/sec, or energy ~0.025 ev. The standard used is stated just after the reference and is generally one known to have a thermal absorption cross section with a 1/v energy dependence. If the nucleus whose cross section is being measured also has a cross section with 1/v dependence, the cross section found for it by comparison with the standard will, of course, be a cross section for 2200 m/sec. If not, and the dependence often is not known, the value found by the comparison is $\overline{\sigma v}/2200$.

Reaction	σ Type	Value	Energy	Ref.
H(n)	σ_a	0.332±0.007	th	53h8
	σ_a	0.329±0.004	th	53h7
	σ_a	0.321 ± 0.005	th	53d7
	σ_t as f(T) for H_2		~0.034 ev	52g2
	σ_t	4.23	1.001	53f4
	σ_t	3.675±0.020	1.311	53f6
	σ_t	2.525	2.532	53f2
	σ_t	graph	3 - 13	53n1
	σ_t	1.690	4.75	53h3
	σ_t	0.686	14.1	52c1
	σ_t	0.057	126	53t2
	σ_t	0.074 - 0.0413	97 - 220	52m1
	σ_t	0.037	390	53h1
	σ_t	0.034	400	53n2
H^2(n,n)	σ_{el}	table	0.135-0.914	53t4
	$d\sigma_{el}/d\Omega$	graphs	0.135-0.914	53t4
	$d\sigma_{el}/d\Omega$	graphs	0.2-2.5	53a2
H^2(n)	σ_t	graph	0.2-3.0	53a2
He(n,n)	$d\sigma_s/d\Omega$	graph	0.07 ev	53h10
He(n)	σ_t	0.8	0.07 ev	53h10
	σ_t	1.02	14.1	52c1
	σ_t	0.200	84	53h2
Li^6(n,t)He^4		25 mb	14	53f1
Li^6(n,d)He^5		~140 mb*	14.2	52r1
Li^6(n,d)He^5 g.s.		80 mb	14	53f1
Li^6(n,d)He^5 excited		81 mb	14	53f1
Li^6(n,p)He^6		6 mb	14	53f1
Li^6(n,p)	σ(0.83^{s}He)	6.7 mb	14	52b1
Li^6(n)	σ_t	1.39	14.1	52c1

*Erroneously reported as ~14 mb, NSA 6, #20(1952).

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
$Li^7(n,t)He^5$		53 mb	14	53f1
$Li^7(n,d)$	$\sigma(0.83^s He)$	9.8 mb	14	52b1
$Li^7(n)$	σ_t	1.45	14.1	52c1
Be(n)	σ_t	6.04	1ev-5kev	52h5
	σ_t	graph	3 - 13	53n1
	σ_t	0.232	400	53n2
$Be^9(n,\alpha)$	$\sigma(0.83^s He)$	10 mb	14	52b1
$Be^9(n)$	σ_t	1.53	14.1	52c1
B(n)	σ_a	708 ± 12	th	53d7
	σ_a	753 ± 3	th	53c10
	Extrapolated value. E_n=0.025 to 0.00068 ev			
B(n,<11.5n)	σ_{in}	0.69	14	52p2
82% B^{10} (n, <2.6n)		0.24		
$B^{10}(n)$	σ_t	1.47	14.1	52c1
$B^{11}(n)$	σ_t	1.40	14.1	52c1
C(n,<11.5n)	σ_{in}	0.76	14	52p2
(n, <2.6n)		0.28		
C(n,n')	σ(all γ's)	0.19	14	53s8
C(n,n')	σ(~8-Mev γ's)	0.2	14	53b5
	σ(~5-Mev γ's)	0.09	14	53b5
C(n)	σ_t	graph	0.05-1	53k6
	σ_t	2.21	1.32	53s1
	σ_t	graph	2.2-2.8	53d4
	σ_t	graph	3 - 13	53n1
	σ_t	1.32	14.1	52c1
	σ_t	graph	30-139	53t2
	σ_t	0.502 - 0.297	97 - 220	52m1
	σ_t	0.287	390	53h1
	σ_t	0.298	400	53n2
	σ(spallation)		90	53k5
$C^{12}(n,2n)$	$\sigma(20^m C)$	graph	24 - 27	52b1
$C^{13}(n,\gamma)$	$\sigma(5700^y C)$	$\leq$0.01	th	53b11
N(n,<11.5n)	σ_{in}	0.79	14	52p2
(n, <2.6n)		0.46		
(n)	σ_t	graph	1.7 - 4	52j2
	σ_t	graph	1.9-3.8	53m9
	σ_t	1.59	14.1	52c1
$N^{14}(n,t)$	$\bar{\sigma}(t)$	11 ± 2 mb	{fission n's thresh ≈4.4	53f8
$N^{14}(n,2n)$	$\sigma(10^m N)$	5.7 mb	14.5	53p1

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
O(n)	σ_{el}	0.7	14.1	53c3
O(n,<14.1n)	σ_{in}	0.5	14.1	53c3
O(n,n')	σ(~7-Mev γ's)	0.14	14	53b5
	σ(all γ's)	0.52	14	53s8
O(n)	σ_t	graph	3 - 13	53n1
	σ_t	1.6	14.1	53c3
	σ_t	1.58	14.1	52c1
	σ_t	1.68	14	53a1
	σ_t	0.379	400	53n2
$O^{16}(n,p)$	$\sigma(7.3^s N)$	49 mb	14.5	53p1
F(n)	σ_t	1.70	14.1	52c1
$F^{19}(n,2n)$	$\sigma(1.9^h F)$	61 mb	14.5	53p1
$F^{19}(n,p)$	$\sigma(30^s O)$	130 mb	14.5	53p1
Na(n)	σ_t	2.98	1ev-1kev	52h5
	σ_t	graph	1ev-10kev	52h5
	σ_t	graph	1.9-3.8	53m7
	σ_t	graph	2.3-2.8	53d4
	σ_t	1.71	14.1	52c1
	σ_t	graph	0.12 - 1	52s1
$Na^{23}(n,p)$	$\sigma(40^s Ne)$	34 mb	14.5	53p1
$Na^{23}(n,\gamma)$	$\sigma(15.0^h Na)$	0.53	th	53b2
	$\sigma(15.0^h Na)$	0.26 mb	~1	53h11
Mg(n,n)	σ_s free	3.51	0.5-1000 ev	53e6
Mg(n)	σ_t	1.75	14.1	52c1
$Mg^{24}(n,p)$	$\sigma(15.0^h Na)$	190 mb	14.5	53p1
$Mg^{25}(n,p)$	$\sigma(62^s Na)$	45 mb	14.5	53p1
$Mg^{26}(n,\gamma)$	$\sigma(9.6^m Mg)$	0.6 mb	~1	53h11
Al(n,n)	$d\sigma_s/d\Omega$	graph	3.7	53w7
Al(n,<11.5n)	σ_{in}	1.06	14	52p2
(n, <2.6n)		0.62		
Al(n,n')	σ(~2-Mev γ's)	~2	14	53b5
	σ(~8-Mev γ's)	~0.3	14	53b5
	σ(all γ's)	1.7	14	53s8
Al(n)	σ_t	1.64	th	53w6
	σ_t	1.38	5ev - 5kev	52m4
	σ_t	graph	1.9-3.8	53n9
	σ_t	2.55	3.7	53w7
	σ_t	graph	3 - 13	53n1
	σ_t	1.73	14.1	52c1
	σ_t	1.86	14	53a1
	σ_t	graph	30-139	53t2
	σ_t	0.588	400	53n2
$Al^{27}(n,\alpha)$	$\sigma(15.0^h Na)$	79 mb	14.5	53p1
	$\sigma(15.0^h Na)$	135 mb	14.1	52f1
$Al^{27}(n,p)$	$\sigma(9.5^m Mg)$	52 mb	14.5	53p1

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
Al^{27}(n,p)	$\sigma(9.5^m Mg)$	79 mb	14.1	52f1
$Al^{27}(n,\gamma)$	$\sigma(2.3^m Al)$	0.37 mb	~1	53h11
Si(n)	σ_t	graph	1.9-3.8	53m9
	σ_t	graph	3 - 13	53n1
	σ_t	1.86	14.1	52c1
Si^{28}(n,p)	$\sigma(2.4^m Al)$	220 mb	14.5	53p1
Si^{29}(n,p)	$\sigma(6.6^m Al)$	100 mb	14.5	53p1
$Si^{30}(n,\alpha)$	$\sigma(9.5^m Mg)$	46 mb	14.5	53p1
$Si^{30}(n,\gamma)$	$\sigma(2.6^h Si)$	1.1 mb	~1	53h11
P(n)	σ_t	graph	0.1-0.7	53s4
	σ_t	1.97	14.1	52c1
	σ_t	2.22	14	53a1
$P^{31}(n,\alpha)$	$\sigma(2.4^m Al)$	0.15	14.5	53p1
P^{31}(n,p)	$\sigma(2.6^h Si)$	0.064	14.5	53p1
	$\sigma(2.6^h Si)$	0.091	14.1	52f1
S(n)	σ_t	graph	3 - 13	53n1
	σ_t	2.06	14	53a1
	σ_t	1.92	14.1	52c1
	σ_t	0.681	400	53n2
S^{32}(n,p)	$\sigma(14.3^d P)$	0.37	14.5	53p1
S^{33}(n,p)	$\sigma(25^d P)$	0.0023	th	52W1
$S^{34}(n,\alpha)$	$\sigma(26^h Si)$	0.14	14.5	53p1
S^{34}(n,p)	$\sigma(12.4^s P)$	0.085	14.5	53p1
Cl(n)	σ_t	graph	0.1-0.7	53s4
	σ_t	graph	0.15-1	53k6
	σ_t	graph	2.2-2.8	53d4
	σ_t	2.00	14.1	52c1
	σ_t	0.743	400	53n2
$Cl^{35}(n,\alpha)$	$\sigma(\alpha)$	graph	3-4	53a4
$Cl^{35}(n,\alpha)$	$\sigma(14.3^d P)$	0.19	14.5	53p1
Cl^{35}(n,2n)	$\sigma(33^m Cl)$	0.0035	14.5	53p1
$Cl^{37}(n,\alpha)$	$\sigma(12.4^s P)$	0.052	14.5	53p1
Cl^{37}(n,p)	$\sigma(5.0^m S)$	0.033	14.5	53p1
$Cl^{37}(n,\gamma)$	$\sigma(38^m Cl)$	0.74 mb	~1	53h11
$A^{36}(n,\alpha)$	$\sigma(\alpha_0)$*	table	2.1-4.4	53t5
	$\sigma(\alpha_1)$*	table	2.1-4.4	53t5

* α_0 to g.s. S^{33}; α_1 to 1.1-Mev level S^{33}

Reaction	σ Type	Value	Energy	Ref.
A(n)	σ_t	graph	0.4-1.1	53g4
$A^{40}(n,\gamma)$	$\sigma(1.8^h A)$	0.93 mb	~1	53h11
K(n)	σ_t	2.24	14.1	52c1
K^{39}(n)	σ_a	1.9	th	52p1
K^{39}(n,2n)	$\sigma(7.5^m K)$	0.010	14.5	53p1
K^{40}(n)	σ_a	~ 65	th	52p1
K^{41}(n)	σ_a	1.2	th	52p1

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
$K^{41}(n,\alpha)$	$\sigma(38^m Cl)$	0.031	14.5	53p1
K^{41}(n,p)	$\sigma(1.8^h A)$	0.081	14.5	53p1
$K^{41}(n,\gamma)$	$\sigma(12.4^h K)$	2.9 mb	~1	53h11
Ca(n)	σ_t	2.19	14.1	52c1
$Ca^{46}(n,\gamma)$	$\sigma(3.4^d Sc)$	0.25	th	53c6
$Ca^{48}(n,\gamma)$	$\sigma(8.5^m Ca)$	1.9 mb	~1	53h11
Sc(n)	σ_a	23	th	53l1
	σ_a	23	th	52p3
Sc(n,n)	σ_s coh	18		53m7
Sc(n)	σ_t	24		53m7
$Sc^{45}(n,\gamma)$	$\sigma(85^d Sc)$	22	th	53l2
Ti(n)	σ_t	graph	2.2-2.8	53d4
	σ_t	2.28	14.1	52c1
Ti^{48}(n,p)	$\sigma(1.8^d Sc)$	0.093	14.5	53p1
$Ti^{50}(n,\gamma)$	$\sigma(6^m Ti)$	1.9 mb	~1	53h11
V(n)	σ_t	graph	0.02 - 5ev	53b4
$V^{51}(n,\alpha)$	$\sigma(1.8^d Sc)$	0.029	14.5	53p1
V^{51}(n,p)	$\sigma(6^m Ti)$	0.027	14.5	53p1
$V^{51}(n,\gamma)$	$\sigma(3.7^m V)$	1.8 mb	~1	53h11
Cr(n)	σ_t	2.45	14.1	52c1
Cr^{52}(n,p)	$\sigma(3.7^m V)$	0.078	14.5	53p1
$Mn(n,\gamma)$	$\sigma(2.6^h Mn)$	12.0	th	52b2
Mn(n)	σ_t	2.54	14.1	52c1
$Mn^{55}(n,\alpha)$	$\sigma(3.7^m V)$	0.052	14.5	53p1
$Mn^{55}(n,\gamma)$	$\sigma(2.6^h Mn)$	12.7	th	53b2
	$\sigma(2.6^h Mn)$	3.82 mb	~1	53h11
Fe(n,n)	σ_s incoh	0.43		53g5
	σ_s free	11.39		53g5
	σ_{el}	2.0	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
	$d\sigma_s/d\Omega$	graph	3.7	53w7
Fe(n, $<$11.5n)	σ_{in}	1.45	14	52p2
(n, $<$2.6n)		1.21		
(n, $<$1.4n)		0.78		
Fe(n,n')	σ(all γ's)	4.6	14	53s2
	σ(~6.5Mev γ's)	~0.5	14	53b5
	σ(~2.5Mev γ's)	~2.4	14	53b5
Fe(n)	σ_t	2.60	14.1	52c1
	σ_t	graph	1 - 3.2	52m2
	σ_t	3.51	3.7	53w7
	σ_t	graph	3 - 13	53n1
	σ_t	1.07	400	53n2
Fe^{56}(n,p)	$\sigma(2.6^h Mn)$	0.124	14.1	52f1
	$\sigma(2.6^h Mn)$	0.097	14.5	53p1
Fe^{56}(n,n')	$\sigma(0.85\gamma)$	~0.4	1.23	53r1

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
Co(n)	σ_t	graph	1ev - 5kev	52m4
	σ_t	graph	0.1 - 3	53w2
	σ_t	2.72	14.1	52c1
$Co^{59}(n,\alpha)$	$\sigma(2.6^h Mn)$	0.039	14.5	53p1
$Co^{59}(n,\gamma)$	$\sigma(10.7^m Co)$	19	th	53m8
	$\sigma(10.7^m Co)$	<0.008	~0.025	53k4
	$\sigma(10.7^m Co)$	4.6 mb	~1	53h11
$10.7^m Co^{60}(n,\gamma)$	$\sigma(1.7^h Co)$	~90	pile	53f15
$5.2^y Co^{60}(n,\gamma)$	$\sigma(1.7^h Co)$	~6	pile	53f15
Ni(n,n)	$\sigma_s$coh	12.9		53g5
	$\sigma_s$free	17.43		53g5
	σ_{el}	2.8	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
Ni(n,n')	σ(all γ's)	6	14	53s8
Ni(n)	σ_t	graph	5ev - 5kev	52m4
	σ_t	2.67	14.1	52c1
	σ_t	graph	1 - 3.2	52m2
$Ni^{58}(n)$	σ_a	4.2	th	52p1
$Ni^{58}(n,2n)$	$\sigma(36^h Ni)$	0.041	14.5	53p1
$Ni^{60}(n)$	σ_a	2.5	th	52p1
$Ni^{61}(n)$	σ_a	2	th	52p1
$Ni^{61}(n,p)$	$\sigma(1.7^h Co)$	0.18	14.5	53p1
$Ni^{62}(n)$	σ_a	15	th	52p1
$Ni^{64}(n,\gamma)$	$\sigma(2.6^h Ni)$	5.1 mb	~1	53h11
Cu(n,n)	σ_{el}	2.9	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
Cu(n,<11.5n)	σ_{in}	1.51	14	52p2
(n, <2.6n)		1.32		
(n, <1.4n)		0.87		
Cu(n,n')	σ(all γ's)	6.3	14	53s8
Cu (n)	σ_t	graph	1 - 3.2	52m2
	σ_t	graph	3 - 13	53n1
	σ_t	2.5	14	52g1
	σ_t	2.96	14.1	52c1
	σ_t	3.09	14	53a1
	σ_t	table	30 - 153	53t2
	σ_t	1.19	400	53n2
$Cu^{63}(n,2n)$	$\sigma(10^m Cu)$	0.510	14.1	52f1
	$\sigma(10^m Cu)$	0.48	14.5	53p1
	$\sigma(10^m Cu)$	graph	12 - 27	52b2
	$\sigma(10^m Cu)$	graph	13 - 27	53b6
$Cu^{63}(n,\gamma)$	$\sigma(12.9^h Cu)$	0.12	~0.025	53k4
	$\sigma(12.9^h Cu)$	11.4 mb	~1	53h11
$Cu^{65}(n,2n)$	$\sigma(12.9^h Cu)$	0.970	14.1	52f1
$Cu^{65}(n,2n)$	$\sigma(12.9^h Cu)$	1.10	14.5	53p1
$Cu^{65}(n,p)$	$\sigma(2.56^h Ni)$	0.019	14.1	52f1
$Cu^{65}(n,\gamma)$	$\sigma(5.1^h Cu)$	6.0 mb	~1	53h11
Zn(n)	σ_{el}	3.3	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
Zn (n)	σ_t	3.06	14.1	52c1
	σ_t	graph	1 - 3.2	52m2
$Zn^{64}(n,2n)$	$\sigma(38^m Zn)$	0.22	14.5	53p1
$Zn^{64}(n,p)$	$\sigma(12.9^h Cu)$	0.39	14.5	53p1
$Zn^{66}(n,p)$	$\sigma(5^m Cu)$	0.10	14.5	53p1
$Zn^{68}(n,\gamma)$	$\sigma(14^h Zn)$	15.2 mb	~1	53h11
	$\sigma(52^m Zn)$	8.0 mb	~1	53h11
Ga(n)	σ_t	graph	5ev - 5kev	52m4
	σ_t	3.19	14.1	52c1
	σ_t	graph	0.1 - 3	53w2
$Ga^{69}(n)$	σ_a	2.0	th	52p1
$Ga^{69}(n,\alpha)$	$\sigma(5^m Cu)$	0.10	14.5	53p1
$Ga^{69}(n,2n)$	$\sigma(68^m Ga)$	0.55	14.5	53p1
$Ga^{69}(n,p)$	$\sigma(14^h Zn)$	0.024	14.5	53p1
$Ga^{69}(n,\gamma)$	$\sigma(20^m Ga)$	20.9 mb	~1	53h11
$Ga^{71}(n)$	σ_a	4.9	th	52p1
$Ga^{71}(n,2n)$	$\sigma(20^m Ga)$	0.70	14.5	53p1
Ge(n)	σ_t	graph	0.4 - 3.5	52j2
$Ge^{70}(n,2n)$	$\sigma(40^h Ge)$	0.67	14.5	53p1
$Ge^{70}(n,p)$	$\sigma(20^m Ga)$	0.13	14.5	53p1
$Ge^{72}(n,p)$	$\sigma(14^h Ga)$	0.065	14.5	53p1
$Ge^{73}(n,p)$	$\sigma(5.0^h Ga)$	0.14	14.5	53p1
$Ge^{74}(n,\alpha)$	$\sigma(2.2^m Zn)$	0.015	14.5	53p1
$Ge^{74}(n,\gamma)$	$\sigma(82^m Ge)$	0.038	~0.025	53k4
	$\sigma(82^m Ge)$	12 mb	~1	53h11
$Ge^{76}(n,2n)$	$\sigma(82^m Ge)$	1.80	14.5	53p1
$As^{75}(n,\alpha)$	$\sigma(14^h Ga)$	0.012	14.5	53p1
$As^{75}(n,2n)$	$\sigma(17^d As)$	0.54	14.5	53p1
$As^{75}(n,p)$	$\sigma(82^m Ge)$	0.012	14.5	53p1
$As^{75}(n,\gamma)$	$\sigma(27^h As)$	22.5 mb	~1	53h11
Se(n)	σ_t	graph	0.4 - 3.5	52j2
	σ_t	graph	0.1 - 3	53w2
	σ_t	3.56	14.1	52c1
$Se^{74}(n)$	σ_a	50	th	52p1
$Se^{76}(n)$	σ_a	82	th	52p1
$Se^{77}(n)$	σ_a	40	th	52p1
$Se^{77}(n,p)$	$\sigma(40^h As)$	0.045	14.5	53p1
$Se^{78}(n)$	σ_a	0.4	th	52p1
$Se^{80}(n)$	σ_a	0.59	th	52p1
$Se^{80}(n,\alpha)$	$\sigma(59^s Ge)$	0.038	14.5	53p1
$Se^{82}(n)$	σ_a	2	th	52p1
$Se^{82}(n,2n)$	$\sigma(59^m Se)$	1.5	14.5	53p1
Br(n)	σ_t	graph	2.2-2.8	53d4
	σ_t	3.52	14.1	52c1
$Br^{79}(n,2n)$	$\sigma(6.4^m Br)$	1.10	14.5	53p1
$Br^{79}(n,\gamma)$	$\sigma(4.4^h Br)$	13.5 mb	~1	53h11
	$\sigma(18.5^m Br)$	29 mb	~1	53h11
$Br^{81}(n,\alpha)$	$\sigma(90^m As)$	0.10	14.5	53p1
$Br^{81}(n,2n)$	$\sigma(4.4^h Br$	0.83	14.5	53p1

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
$Br^{81}(n,\gamma)$	$\sigma(36^h Br)$	17 mb	~1	53h11
$Kr^{78}(n)$	$\sigma(34^h Kr)$	1.6	th	52b5
$Kr^{84}(n,\gamma)$	$\sigma(4.4^h Kr)$	1.9 mb	~1	53h11
	$\sigma(10^y Kr)$	<8 mb	~1	53h11
$Kr^{86}(n,\gamma)$	$\sigma(78^m Kr)$	2.4 mb	~1	53h11
$Rb^{85}(n,\gamma)$	$\sigma(19^d Rb)$	23.1 mb	~1	53h11
$Rb^{87}(n,\alpha)$	$\sigma(33^m Br)$	0.039	14.5	53p1
$Rb^{87}(n,\gamma)$	$\sigma(17.8^m Rb)$	1.8 mb	~1	53h11
$Sr(n)$	σ_t	graph	0.05 - 3.2	52m2
	σ_t	3.68	14.1	52c1
$Sr^{84}(n,\gamma)$	$\sigma(65^d Sr)$	0.32	th	52h2
	$\sigma(65^d Sr)$	1.2	th	53l2
$Sr^{88}(n,\alpha)$	$\sigma(4.4^h Kr)$	0.064	14.5	53p1
$Sr^{88}(n,p)$	$\sigma(17.8^m Rb)$	0.018	14.5	53p1
$Sr^{88}(n,\gamma)$	$\sigma(53^d Sr)$	2.1 mb	~1	53h11
$Y(n)$	σ_t	graph	0.05 - 3.2	52m2
	σ_t	3.88	14.1	52c1
$Y^{89}(n,\alpha)$	$\sigma(19^d Rb)$	0.070	14.5	53p1
$Y^{89}(n,\gamma)$	$\sigma(61^h Y)$	7.0 mb	~1	53h11
$Zr(n)$	σ_t	graph	1 - 3.2	52m2
	σ_t	graph	3 - 13	53n1
	σ_t	3.6	14	52g1
	σ	4.00	14.1	52c1
$Zr^{90}(n,\alpha)$	$\sigma(2.8^h Sr)$	0.2	14.5	53p1
$Zr^{90}(n,2n)$	$\sigma(4.5^m Zr)$	0.08	14.5	53p1
$Zr^{90}(n,p)$	$\sigma(61^h Y)$	0.25	14.5	53p1
$Zr^{94}(n,p)$	$\sigma(16^m Y)$	0.01	14.5	53p1
$Nb(n)$	σ_t	graph	0.12 - 3.2	52m2
	σ_t	4.02	14.1	52c1
$Nb^{93}(n,\gamma)$	$\sigma(6.6^m Nb)$	41 mb	~1	53h11
$Nb^{94}(n,\gamma)$	$\sigma(35^d Nb)$	~15	pile	53d2
$Mo(n)$	σ_t	graph	1ev - 10kev	52h5
	σ_t	graph	0.02 - 3.2	52m2
	σ_t	4.04	14.1	52c1
$Mo^{92}(n)$	σ_a	<0.3	th	52p1
$Mo^{92}(n,2n)$	$\sigma(15.5^m Mo)$	graph	13.2 - 27	52b2
	$\sigma(15.5^m + 75^s Mo)$	0.19	14.5	53p1
	$\sigma(15.5^m Mo)$	graph	13 - 27	53b6
$Mo^{97}(n,p)$	$\sigma(76^m Nb)$	0.1	14.5	53p1
$Mo^{98}(n,\gamma)$	$\sigma(68^h Mo)$	10.4 mb	~1	53h11
$Mo^{100}(n,2n)$	$\sigma(68^h Mo)$	3.8	14.5	53p1

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
$Mo^{100}(n,\gamma)$	$\sigma(15.5^m Mo)$	12.3 mb	~1	53h11
$Ru^{96}(n,2n)$	$\sigma(1.6^h Ru)$	0.48	14.5	53p1
$Ru^{101}(n,p)$	$\sigma(15^m Tc)$	0.002	14.5	53p1
$Ru^{102}(n,\gamma)$	$\sigma(42^d Ru)$	30 mb	~1	53h11
$Ru^{104}(n,\gamma)$	$\sigma(4.4^h Ru)$	31 mb	~1	53h11
$Rh(n)$	σ_s	4.1	0.15 ev	53b4
	σ_s free	5.5	1.26 ev	53s7
$Rh^{103}(n,\gamma)$	$\sigma(4.3^m Rh)$	15.4 mb	~1	53h11
	$\sigma(44^s Rh)$	94 mb	~1	53h11
$Pd^{102}(n,\gamma)$	$\sigma(17^d Pd)$	4.8	pile	53m5
$Pd^{104}(n,p)$	$\sigma(4.3^m + 44^s Rh)$	0.13	14.5	53p1
$Pd^{105}(n,p)$	$\sigma(36^h Rh)$	0.7	14.5	53p1
$Pd^{108}(n,\gamma)$	$\sigma(13^h Pd)$	108 mb	~1	53h11
$Pd^{110}(n,\alpha)$	$\sigma(4^m Ru)$	0.014	14.5	53p1
$Pd^{110}(n,2n)$	$\sigma(13^h Pd)$	1.9	14.5	53p1
$Ag(n,n)$	σ_{el}	4.2	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
$Ag(n)$	σ_t	graph	12ev - 5kev	52m4
	σ_t	graph	1 - 3.2	52m2
	σ_t	4.34	14.1	52c1
$Ag^{107}(n,2n)$	$\sigma(24.5^m Ag)$	0.56	14.1	52f1
	$\sigma(24.5^m Ag)$	0.5	14.5	53p1
$Ag^{107}(n,\gamma)$	$\sigma(2.3^m Ag)$	85 mb	~1	53h11
$Ag^{109}(n,2n)$	$\sigma(2.3^m Ag)$	1.0	14.1	52f1
	$\sigma(2.3^m Ag)$	0.3	14.5	53p1
$Ag^{109}(n,\gamma)$	$\sigma(24.5^s Ag)$	174 mb	~1	53h11
$Cd(n,n)$	σ_{el}	5.2	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
$Cd(n,n')$	$\sigma(49^m Cd)$	0.21	1.27	53f3
		graph	0.4 - 1.3	53f3
$Cd(n,<11.5n)$	σ_{in}	1.89	14	52p2
$(n,<2.6n)$		1.66		
$(n,<1.4n)$		1.14		
$Cd(n,n')$	σ(all γ's)	12.8	~1	53s8
$Cd(n)$	σ_s/σ_a	graph	0.025 - 0.4 ev	53b4
	σ_t	7800	0.175 ev	53b4
	σ_t	graph	0.1 - 3	53w2
	σ_t	graph	0.4 - 3.5	52j2
	σ_t	4.44	14.1	52c1
	σ_t	table	37 - 153	53t2
	σ_t	1.84	400	53n2
$Cd^{110}(n,\gamma)$	$\sigma(49^m Cd)$	<0.001	0.2 - 0.4	53f3
$In(n,n)$	σ_{el}	6.1	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
In(n)	σ_t	graph	1 - 3.2	52m2
	σ_t	4.53	14.1	52c1
$In^{115}(n,\gamma)$	$\sigma(54^m In)$	166 mb	~1	53h11
	$\sigma(13^s In)$	57 mb	~1	53h11
$In^{115}(n,n')$	$\sigma(4.5^h In)$	graph	0.44-5.5	53m10
Sn(n,n)	σ_{el}	6.0	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
Sn(n)	σ_t	graph	1 - 3.2	52m2
	σ_t	4.68	14.1	52c1
$Sn^{120}(n,\gamma)$	$\sigma(27.5^h Sn)$	14 mb	~1	53h11
$Sn^{122}(n,\gamma)$	$\sigma(40^m Sn)$	12 mb	~1	53h11
$Sn^{124}(n,\gamma)$	$\sigma(10^d Sn)$	4 mb	~1	53h11
	$\sigma(9.5^m Sn)$	15 mb	~1	53h11
Sb(n)	σ_t	graph	1 - 3.2	52m2
	σ_t	4.71	14.1	52c1
$Sb^{121}(n)$	σ_a	5.7	th	52p1
$Sb^{121}(n,2n)$	$\sigma(16.6^m Sb)$	0.75	14.5	53p1
$Sb^{121}(n,\gamma)$	$\sigma(2.8^d Sb)$	90 mb	~1	53h11
$Sb^{123}(n,2n)$	$\sigma(2.8^d Sb)$	1.2	14.5	53p1
Te(n)	σ_t	graph	0.1 - 3	53w2
	σ_t	4.9	14.1	52c1
$Te^{128}(n,2n)$	$\sigma(9.3^h Te)$	0.78	14.5	53p1
$Te^{130}(n,2n)$	$\sigma(72^m + 32^d Te)$	0.60	14.5	53p1
I(n)	σ_t	graph	5ev - 5kev	52m4
	σ_t	graph	1 - 3.2	52m2
	σ_t	4.7	14.1	52c1
$I^{127}(n,\alpha)$	$\sigma(21^m Sb)$	0.018	14.5	53p1
$I^{127}(n,2n)$	$\sigma(13.0^d I)$	1.1	14.5	53p1
		graph	12 - 18	53m4
$I^{127}(n,p)$	$\sigma(9.3^h Te)$	0.23	14.5	53p1
$I^{127}(n,\gamma)$	$\sigma(25^m I)$	graph	0.25 - 1.6	53m4
	$\sigma(25^m I)$	105 mb	~1	53h11
NaI(n)	σ_a	7.4	th	53h7
$Xe^{136}(n,\gamma)$	$\sigma(3.9^m Xe)$	1.0 mb	~1	53h11
Ba(n)	σ_t	graph	0.05 - 3.2	52m2
	σ_t	5.2	14.1	52c1
$Ba^{138}(n,p)$	$\sigma(33^m Cs)$	0.006	14.5	53p1
$Ba^{138}(n,\gamma)$	$\sigma(85^m Ba)$	0.074	~ 0.025	53k4
	$\sigma(85^m Ba)$	2.3 mb	~1	53h11

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
La(n)	σ_s coh	8.7		53k10
	σ_s	9.3		53k10
	σ_t	14.3	0.07 ev	53k10
	σ_t	graph	0.02 - 3.2	52m2
	σ_t	5.2	14.1	52c1
$La^{139}(n,p)$	$\sigma(85^m Ba)$	0.006	14.5	53p1
$La^{139}(n,\gamma)$	$\sigma(40^h La)$	5.0 mb	~1	53h11
Ce(n)	σ_s coh	2.2		53k10
	Low value due to impurities? Value calc. from Ce^{140} and Ce^{142} is 2.7			
	σ_t	graph	0.02 - 3.2	52m2
	σ_t	5.1	14.1	52c1
$Ce^{140}(n)$	σ_s coh	2.8		53k10
$Ce^{140}(n,\alpha)$	$\sigma(2.6^m Ba)$	0.012	14.5	53p1
$Ce^{140}(n,\gamma)$	$\sigma(28^d Ce)$	5.4 mb	~1	53h11
$Ce^{142}(n)$	σ_s coh	2.6		53k10
$Ce^{142}(n,\gamma)$	$\sigma(33^h Ce)$	4.2 mb	~1	53h11
Pr(n)	σ_t	graph	0.05 - 3.2	52m2
	σ_t	4.9	14.1	52c1
$Pr^{141}(n)$	σ_s coh	2.4		53k10
	σ_s bound	4.0		53k10
$Pr^{141}(n,2n)$	$\sigma(3.6^m Pr)$	2.1	14.5	53p1
$Pr^{141}(n,\gamma)$	$\sigma(19^h Pr)$	11 mb	~1	53h11
Nd	σ_s coh	6.5		53k10
	σ_s bound	~16		53k10
Nd^{142}	σ_s coh	7.5		53k10
$Nd^{142}(n)$	σ_a	18	th	52p1
	σ_a	13	pile	53w4
$Nd^{143}(n)$	σ_a	290	th	52p1
	σ_a	334	pile	53w4
$Nd^{144}(n)$	σ_s coh	1.0		53k10
	σ_a	4.8	th	52p1
	σ_a	~0	pile	53w4
$Nd^{145}(n)$	σ_a	52	th	52p1
	σ_a	37	pile	53w4
$Nd^{146}(n)$	σ_s coh	9.5		53k10
	σ_a	9.8	th	52p1
	σ_a	~4	pile	53w4
$Nd^{146}(n,\gamma)$	$\sigma(11^d Nd)$	40 mb	~1	53h11
$Nd^{148}(n)$	σ_a	~3.3	th	52p1
	σ_a	~4	pile	53w4
$Nd^{148}(n,\gamma)$	$\sigma(1.7^h Nd)$	80 mb	~1	53h11
$Nd^{150}(n)$	σ_a	~3	th	52p1
	σ_a	~0	pile	53w4
$Sm^{152}(n)$	σ_s coh	~3 (-)		53k10
$Sm^{152}(n,\alpha)$	$\sigma(1.7^h Nd)$	0.009	14.5	53p1
$Sm^{154}(n)$	σ_s coh	~6		53k10

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
$Sm^{154}(n,2n)$	$\sigma(47^h Sm)$	0.22	14.5	53p1
$Sm_2O_3(n)$	σ_s/σ_a	graph	0.025 - 0.16 ev	53b4
Single level indicated				
$Eu_2O_3(n)$	σ_s/σ_a	graph	0.025 - 0.16 ev	53b4
$Gd^{160}(n,2n)$	$\sigma(18.0^h Gd)$	1.5	14.5	53p1
$Gd_2O_3(n)$	σ_s/σ_a	graph	0.025 - 0.16 ev	53b4
Two levels indicated				
$Dy_2O_3(n)$	σ_s/σ_a	graph	0.025 - 0.13 ev	53b4
Er(n)	$\sigma_s$coh	7.8		53k10
	$\sigma_s$bound	~16		53k10
	σ_t	138	0.06 ev	53k10
$Lu^{175}(n,\gamma)$	$\sigma(3.7^h Lu)$	158 mb	~1	53h11
$Lu^{176}(n,\gamma)$	$\sigma(6.7^d Lu)$	330 mb	~1	53h11
Hf(n,n)	σ_a	4.7	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
$Hf^{174}(n)$	σ_a	~500	th	52p1
$Hf^{176}(n)$	σ_a	~15	th	52p1
$Hf^{177}(n)$	σ_a	380	th	52p1
$Hf^{178}(n)$	σ_a	70	th	52p1
$Hf^{179}(n)$	σ_a	~50	th	52p1
$Hf^{180}(n)$	σ_a	~13	th	52p1
Ta(n)	σ_t	graph	1 - 3.2	52m2
	σ_t	5.2	14.1	52c1
$Ta^{181}(n,2n)$	$\sigma(8.0^h Ta)$	0.9	14.5	53p1
$Ta^{181}(n,\gamma)$	$\sigma(117^d Ta)$	142 mb	~1	53h11
W(n)	σ_t	graph	1 - 3.2	52m2
	σ_t	5.3	14.1	52c1
$W^{186}(n,\gamma)$	$\sigma(24^h W)$	0.42	~ 0.025	53k4
	$\sigma(24^h W)$	71 mb	~1	53h11
$Re^{185}(n,\gamma)$	$\sigma(93^h Re)$	180 mb	~1	53h11
$Re^{187}(n,\gamma)$	$\sigma(19^h Re)$	165 mb	~1	53h11
Pt(n)	σ_t	graph	0.1 - 3	53w2
	σ_t	5.4	14.1	52c1
$Pt^{198}(n,2n)$	$\sigma(18^h Pt)$	3	14.5	53p1
$Pt^{198}(n,\gamma)$	$\sigma(29^m Pt)$	64 mb	~1	53h11

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
Au(n)	σ_a	97.5	th	53c10
Extrapolated value assuming 1/v. E_n=0.0035 to 0.00068 ev				
Au(n,<11.5n)	σ_{in}	2.51	14	52p2
(n, <2.6n)		2.06		
(n, <1.4)		1.47		
Au(n)	σ_t	graph	0.1-0.7	53s4
	σ_t	graph	0.1 - 3	53w2
	σ_t	5.1	14	53a1
	σ_t	5.3	14.1	52c1
$Au^{197}(n,2n)$	$\sigma(5.6^d Au)$	1.7	14.5	53p1
$Au^{197}(n,\gamma)$	$\sigma(2.7^d Au)$	120 mb	~1	53h11
$Au^{197}(n,n')$	$\sigma(7.4^s Au)$	graph	0.42-5.5	53m10
Hg(n)	σ_t	graph	3ev - 10kev	52h5
	σ_t	graph	0.1 - 3	53w2
	σ_t	graph	0.4 - 3.5	52j2
	σ_t	5.3	14	53a1
	σ_t	5.4	14.1	52c1
$Hg^{204}(n,\gamma)$	$\sigma(5.5^m Hg)$	102 mb	~1	53h11
Tl(n)	σ_t	5.4	14.1	52c1
$Tl^{205}(n,p)$	$\sigma(5.5^m Hg)$	0.003	14.5	53p1
Pb(n,n)	$d\sigma_s/d\Omega$	graph	0.07 ev	53m11
	$d\sigma_s/d\Omega$	graph	3.7	53w7
	σ_{el}	4.6	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
Pb(n,<11.5n)	σ_{in}	2.56	14	52p2
(n, <2.6n)		2.29		
(n, <1.4n)		0.91		
Pb(n,n')	σ(~3.5 Mev γ's)	~0.3	14	53b5
	σ(~2.5 Mev γ's)	~4	14	53b5
	σ(all γ's)	4.2	14	53s8
Pb(n)	σ_t	graph	0.0013-0.02 ev	53m11
	σ_t	8.63	th	53w6
	σ_t	graph	1 - 3.2	52m2
	σ_t	7.60	3.7	53w7
	σ_t	graph	3 - 13	53n1
	σ_t	5.8	14	53a1
	σ_t	5.4	14.1	52c1
	σ_t	4.22	55	53r2
	σ_t	4.87	85	53r2
	σ_t	table	37 - 153	53t2
	σ_t	2.89	400	53n2
$Pb^{204}(n)$	σ_a	~0.9	th	52p1
$Pb^{206}(n)$	σ_a	~0.1	th	52p1
	σ_t	graph	1 - 3.2	52m2
$Pb^{207}(n)$	σ_a	0.70	th	52p1
$Pb^{208}(n)$	σ_a	≤0.3	th	52p1
$Pb^{208}(n,p)$	$\sigma(3.1^m Tl)$	0.001	14.5	53p1
$Pb^{208}(n,\gamma)$	$\sigma(3.3^h Pb)$	0.002	~1	53h11

Neutron Cross Sections - continued

Reaction	σ Type	Value	Energy	Ref.
Bi(n)	σ_a	0.031	pile	53l3
Bi(n,n)	σ_{el}	4.8	1.0	53w3
	$d\sigma_{el}/d\Omega$	graph	1.0	53w3
Bi(n,<11.5n)	σ_{in}	2.56	14	52p2
(n, <2.6n)		2.28		
(n, <1.4n)		1.03		
Bi(n)	σ_t	graph	1 - 3.2	52m2
	σ_t	graph	3 - 13	53n1
	σ_t	5.4	14	53a1
	σ_t	5.5	14.1	52c1
$Bi^{209}(n,\alpha)$	$\sigma(4.2^m Tl)$	0.001	14.5	53p1
$Bi^{209}(n,\gamma)$	$\sigma(5^d Bi)$	0.21	pile	53l3
$(n,\gamma\beta)$	$\sigma(138^d Po)$			
(n,γ)	$\sigma(5^d Bi)$	0.0034	~1	53h11
$Rn^{222}(n)$	$\sigma(11.2^d Ra^{223})$	0.7	pile	53b9
$Ra^{226}(n,\gamma)$	$\sigma(42^m Ra^{227})$	22	th ?	52b4
$Ac^{227}(n)$	σ_a	500	th	52p3
Th(n)	σ_t	graph	2ev - 2kev	52h5
	σ_t	graph	0.1 - 3	53w2
	σ_t	6.11	13.9	50l1
	σ_t	3.23	400	53n2
$Th^{230}(n)$	σ_a	30 - 60	pile	49h1
$Pa^{230}(n)$	σ_a	~1500	pile	47g1
$Pa^{231}(n,\gamma\beta^-)$	$\sigma(70^y U)$	290	pile	53e3
$Pa^{232}(n,\gamma)$	$\sigma(27.4^d Pa)$	~40	pile	53e3
U(n)	σ_s coh	9.0	th	51s1
	σ_t	9.0	th	51s1
	σ_t	graph	3.7 - 800ev	53b5
	σ_t	graph	3 - 13	53n1
	σ_t	5.9	14.1	52c1
	σ_t	5.7	14.1	52c1
	σ_t	3.26	400	53n2
$U^{232}(n)$	σ_a	<500	pile	53e1
$U^{232}(n,f)$	σ_f	~80	th	53e1
$U^{234}(n,f)$	σ_f	graph	0.4-4.0	53l4

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GROUND STATE Q'S

Reaction	Standard	Value	Method	Ref.
$H^2(d,n)He^3$		+ 3.25 ±0.06	ppl	53d5
$H^3(p,\gamma)He^4$	$Li^7(p,\gamma)$	+19.7 ± 0.4	scin	53w5
$H^3(d,n)He^4$		+17.7 ±0.3	ppl	53r3
$H^3(He^3,p)He^5$		+11.18 ± 0.07	ppl	53a5
$He^3(He^3,p)Li^5$		+10.86 ± 0.15	ppl	53a5
$He^5 \longrightarrow \alpha + n$		+ 0.90 ± 0.07	ppl	53a5

Ground State Q's - continued

Reaction	Standard	Value	Method	Ref.
$He^5 \longrightarrow \alpha + n$		+ 0.95 ±0.07	range	53m6
$Li^6(p,\alpha)He^3$	absolute	+ 4.023 ± 0.003	s	53c1
$Li^6(d,\alpha)He^4$	absolute	+22.396 ± 0.012	s	53c1
$Li^6(d,\alpha)He^4$		+ 22.375 ±0.014	s	53p2
$Li^6(d,tp)He^4$		+ 2.51 ±0.04	s	53f5
$Li^6(d,t)Li^5$		+ 0.9 ±0.1	s	53f5
$Li^6(d,p)Li^7$	absolute	+ 5.028 ± 0.003	s	53c1
$Li^6(He^3,p)Be^8$	$H^2(He^3,p)$	+16.60 ± 0.25	scin	53k9
$Li^7(p,\alpha)He^4$	absolute	+17.344 ± 0.013	s	53f7
$Li^7(p,\alpha)He^4$	absolute	+17.352 ± 0.009	s	53c1
$Li^7(p,n)Be^7$	Na γ [Mg(p,p')]	- 1.6464 ±0.0009	thresh	53j1
$Li^7(d,\alpha)He^5$		+14.2 ±0.1	ppl	53c8
$Be^8 \longrightarrow 2\alpha$	$Li^7(p,n)$	+ 0.0945 ± 0.0014	EA	53j2
$Be^9(n,\gamma)Be^{10}$	absolute	+ 6.816±0.006	pair s	53k7
$Be^9(p,\alpha)Li^6$	$Li^7(p,n)$	+ 2.126* ±0.004	EA	52c3
$Be^9(p,\alpha)Li^6$	absolute	+ 2.126 ± 0.003	s	53c1
$Be^9(p,d)Be^8$	absolute	+ 0.560 ± 0.003	s	53c1
$Be^9(d,\alpha)Li^7$	absolute	+ 7.153 ± 0.004	s	53c1
$Be^9(d,t)Be^8$		+ 4.60 ± 0.03	ppl	52c2
$B^{10}(n,\alpha)Li^7$	Po^{212} α	+ 2.781 ± 0.025	pc	52h7
$B^{10}(p,\alpha)Be^7$	$Li^7(p,n)$	+ 1.147 ± 0.0025	EA	52c3
$B^{10}(p,He^3)Be^8$	$Li^7(p,n)$	- 0.536 ± 0.003	EA	52c3
$B^{10}(d,\alpha)Be^8$		+ 17.87 ±0.06	s	53c9
$B^{10}(d,\alpha)Be^8$	Bi^{212} Po^{212} α	+17.91 ±0.06	ic	53t3
$B^{11}(p,\alpha)Be^8$	absolute	+ 8.589 ± 0.005	s	53c1
$B^{11}(d,p)B^{12}$		+ 1.140±0.008	s	53e4
$C^{12}(d,p)C^{13}$	absolute	+ 2.722 ± 0.004	s	53f7
$C^{13}(d,\alpha)B^{11}$		+ 5.166±0.005	s	53p2
$N^{14}(n,\gamma)N^{15}$	absolute	+ 10.832±0.008	pair s	53k7
$N^{14}(d,p)N^{15}$	Po^{212} α	+ 8.613 ± 0.011	s	52m5
$N^{14}(d,n)O^{15}$		+ 5.15 ± 0.16	ppl	53e2
$N^{14}(\alpha,p)O^{17}$		- 1.16	ppl	53h4
$N^{15}(p,\alpha)C^{12}$	absolute	+ 4.962 ± 0.004	s	53c1
$O^{16}(d,\alpha)N^{14}$	absolute	+ 3.119± 0.005	s	53f7
$O^{16}(d,\alpha)N^{14}$	Li(p,n)	+ 3.113 ± 0.0035	EA	52c3
$O^{18}(p,\alpha)N^{15}$	$Be^9(d,\alpha)$	+ 3.98 ±0.04	s	51s2
$F^{19}(\alpha,p)Ne^{22}$		+ 1.57	ppl	52h6
$Ne^{21}(p,n)Na^{21}$	$F^{19}(p,n)$	- 3.765		52k1

*Supersedes value of 2.123, R.M.Williamson, et al., Phys. Rev. 84, 731(1951).

Ground State Q's - continued

Reaction	Standard	Value	Method	Ref.
$Ne^{21}(d,\alpha)F^{19}$	Bi^{212} α	+ 6.432 ± 0.010	s	52m5
$Ne^{21}(d,p)Ne^{22}$	Po^{212} α	+ 8.137 ± 0.011	s	52m5
$Ne^{22}(p,n)Na^{22}$	$F^{19}(p,n)$	− 3.913		52k1
$Na^{23}(p,\alpha)Ne^{20}$	$Li^{7}(p,n)$	+ 2.379 ± 0.003	EA	53d1
$Na^{23}(d,p)Na^{24}$	Bi^{212} α	+ 4.723 ± 0.008	s	52m5
$Na^{23}(d,p)Na^{24}$	Po α	+ 4.731 ± 0.007	ppl	52s2
$Na^{23}(\alpha,p)Mg^{26}$		+ 1.55	ppl	52h6
$Mg^{24}(n,\gamma)Mg^{25}$	absolute	+ 7.334±0.007	pair s	53k8
$Mg^{24}(p,\gamma)Al^{25}$	$F(p,\alpha)$	+ 2.1 ± 0.1	scin	53c2
$Mg^{24}(d,n)Al^{25}$		+ 0.07 ± 0.06	ppl	53g2
$Mg^{24}(\alpha,p)Al^{27}$		− 1.613 ± 0.010	s	52k2
$Mg^{26}(n,\gamma)Mg^{27}$	absolute	+ 6.440±0.008	pair s	53k8
$Mg^{26}(p,\gamma)Al^{27}$	$F(p,\alpha)$	+ 8.3 ± 0.4	scin	53c2
$Al^{27}(n,\gamma)Al^{28}$	absolute	+ 7.724±0.006	pair s	53k7
$Al^{27}(p,\alpha)Mg^{24}$	$F^{19}(p,\alpha)$	+ 1.61 ± 0.02	s	53r5
$Al^{27}(p,\alpha)Mg^{24}$	$Li^{7}(p,n)$	+ 1.594 ± 0.002	EA	53d1
$Al^{27}(p,n)Si^{27}$	$F^{19}(p,\alpha\gamma)$	− 5.61 ± 0.01	thresh	53k1
$Al^{27}(d,\alpha p)Na^{24}$		−10.2	thresh	53b13
$Al^{27}(\alpha,p)Si^{30}$		+ 2.26 ± 0.05	ppl	51r1
$Si^{28}(\gamma,n)Si^{27}$		−16.9 ± 0.2	thresh	53s6
$Si^{28}(n,\gamma)Si^{29}$	absolute	+ 8.468±0.008	pair s	53k7
$Si^{28}(p,n)P^{28}$	$Mg^{24}(p,n)$	−15.1 ± 0.5	thresh	53g3
$Si^{29}(n,\gamma)Si^{30}$	absolute	+10.601±0.011	pair s	53k7
$S^{32}(p,n)Cl^{32}$	$Mg^{24}(p,n)$	−13.9 ± 0.5	thresh	53g3
$S^{32}(d,n)Cl^{33}$		+ 0.25 ± 0.07	ppl	53m2
$S^{32}(\alpha,p)Cl^{35}$		− 2.02 ± 0.11	ppl	52f2
Mass (S^{32})/Mass (S^{34})		1.06242	Mic	53b3
$Cl^{35}(n,\alpha)P^{32}$		+ 1.07 ± 0.15	ic	52f2
$Cl^{35}(n,\alpha)P^{32}$	$Po^{212}\alpha$	+ 0.97 ± 0.16	ic	53a3
$Cl^{35}(d,p)Cl^{36}$		+ 6.3		52K3
$A^{36}(n,\alpha)S^{33}$		+ 2.0 ± 0.1	pc	53t5
$K^{39}(n,\gamma)K^{40}$	absolute	+ 7.789 ± 0.008	pair s	53b16
$K^{39}(d,p)K^{40}$	Po α	+ 5.576 ± 0.010	s	53b17
$K^{39}(\alpha,p)Ca^{42}$		−0.18	range	53s5
$K^{40}(n,\gamma)K^{41}$	absolute	+ 9.39 ± 0.06? E_{γ} (max)	pair s	53b16
$K^{41}(n,\gamma)K^{42}$	absolute	+ 7.34 ± 0.02	pair s	53b16
$K^{41}(\alpha,p)Ca^{44}$		+1.20	range	53s5
$Ca^{40}(\gamma,n)Ca^{39}$		−15.8 ± 0.1	thresh	53s6
$Ca^{40}(d,p)Ca^{41}$	$O^{16}(d,p)$	+ 6.14 ± 0.05	ppl	53h9
$Ca^{48}(p,n)Sc^{48}$	$F^{19}(p,\alpha\gamma)$, $Li^{7}(p,n)$	$\geq$−0.64	thresh	53t6

Ground State Q's - continued

Reaction	Standard	Value	Method	Ref.
$Sc^{45}(n,2n)Sc^{44}$		−11.0 ± 0.3	thresh	53b14
$Sc^{45}(n,\gamma)Sc^{46}$	absolute	+ 8.85 ± 0.08	pair s	53b1
$Ti^{46}(d,p)Ti^{47}$	$O^{16}(d,p)$	+ 6.45 ± 0.05	range	52p4
$Ti^{47}(n,\gamma)Ti^{48}$	absolute	+ 9.39 +2.31?	pair s	53k2
$Ti^{47}(d,p)Ti^{48}$	$O^{16}(d,p)$	+ 8.14 ± 0.05 ?	range	52p4
$Ti^{48}(n,\gamma)Ti^{49}$	absolute	+ 6.76 +1.35?	pair s	53k2
$Ti^{48}(d,p)Ti^{49}$	$O^{16}(d,p)$	+ 5.81 ± 0.04	range	52p4
$Ti^{49}(n,\gamma)Ti^{50}$	absolute	+ 9.19 +1.58?	pair s	53k2
$Ti^{49}(d,p)Ti^{50}$	$O^{16}(d,p)$	+ 8.62 ± 0.05	range	52p4
$Ti^{49}(p,n)V^{49}$	$F^{19}(p,\alpha\gamma)$, $Li^{7}(p,n)$	− 1.391±0.005	thresh	53t6
$Ti^{50}(d,p)Ti^{51}$	$O^{16}(d,p)$	+ 4.11 ± 0.07	range	52p4
$V^{51}(n,\gamma)V^{52}$	absolute	+ 7.305 ± 0.007	pair s	53b1
$V^{51}(n,\gamma)V^{52}$	Au, Cs, Na γ's	+ 7.4	scin	53h8
$V^{51}(d,p)V^{52}$		+ 6.25	a, pc	51h1
$V^{51}(d,p)V^{52}$		+5.0		53k11
$Cr^{52}(d,p)Cr^{53}$		+ 5.70	s	53m1
$Cr^{52}(n,\gamma)Cr^{53}$	absolute	+ 7.929 ± 0.008	s	53k2
$Cr^{53}(n,\gamma)Cr^{54}$	absolute	+ 9.716 ± 0.008	s	53k2
$Mn^{55}(n,\gamma)Mn^{56}$	absolute	+ 7.261 ± 0.006	pair s	53b1
$Mn^{55}(p,n)Fe^{55}$	$F^{19}(p,\alpha\gamma)$, $Li^{7}(p,n)$	− 1.020±0.005	thresh	53t6
$Fe^{54}(n,\gamma)Fe^{55}$	absolute	+ 9.298 ± 0.007	pair s	53k2
$Fe^{56}(n,\gamma)Fe^{57}$	absolute	+ 7.639 ± 0.004 (+0, 0.014, or 0.13)	pair s	53k2
$Fe^{57}(n,\gamma)Fe^{58}$	absolute	+10.16 ± 0.04	pair s	53k2
$Co^{59}(n,\gamma)Co^{60}$	absolute	+ 7.486 ± 0.006	pair s	53b1
$Ni^{58}(d,p)Ni^{59}$		+ 6.77	ppl	53m1
$Ni^{58}(n,\gamma)Ni^{59}$	absolute	+ 8.997 ± 0.005	pair s	53k2
$Ni^{60}(n,\gamma)Ni^{61}$	absolute	+ 8.532 ± 0.008	pair s	53k2
$Cu^{63}(\gamma,n)Cu^{62}$	Q value masses	−10.61 ± 0.05	thresh	53b7
$Cu^{63}(n,\gamma)Cu^{64}$	absolute	+ 7.914 ± 0.004	pair s	53b1
$Cu^{65}(n,\gamma)Cu^{66}$	absolute	+ 7.634 ± 0.006? See Cu^{66}	pair s	53b1
$Zn^{64}(p,n)Ga^{64}$	$Cu^{63}(p,n)$, $Zn^{66}(p,n)$	+ 8.0 ± 0.5	thresh	53c7
$Zn^{65}(n,\gamma)Zn^{66}$	absolute	+ 7.876 ± 0.007	pair s	53k2
$Zn^{67}(n,\gamma)Zn^{68}$	absolute	+ 9.51 ± 0.03 ?	pair s	53k2
$Zn^{67}(p,n)Ga^{67}$	$F^{19}(p,\alpha\gamma)$, $Li(p,n)$	− 1.785±0.005	thresh	53t6
$Zn^{70}(p,n)Ga^{70}$	"	− 1.45 ± 0.03	thresh	53t6

Ground State Q's - continued

Reaction	Standard	Value	Method	Ref.
$Ga^{71}(p,n)Ge^{71}$	$F^{19}(p,\alpha\gamma)$ / $Li(p,n)$	-1.03 ±0.03	thresh	53t6
$Ge^{70}(n,2n)Ge^{69}$		-11.6 ±0.3	thresh	53b14
$Ge^{73}(p,n)As^{73}$	"	-1.15 ±0.03	thresh	53t6
$As^{75}(p,n)Se^{75}$	"	-1.652±0.005	thresh	53t6
$Sr^{88}(d,p)Sr^{89}$	$O^{16}(d,p)$	+ 4.18 ±0.08	ppl	53h9
$Sr^{88}(d,p)Sr^{89}$		+ 4.33 ±0.10	s	53m1
$Mo^{92}(\gamma,n)Mo^{91}$		-13.1 ±0.1	thresh	53k3
$Mo^{92}(n,2n)Mo^{91}$		-12.34	thresh	53b6
$Mo^{100}(\gamma,n)Mo^{99}$		- 8.1	thresh	53d6
$Ag^{109}(\gamma,n)Ag^{108}$	Q value masses	- 9.07 ±0.07	thresh	53b7
$Ag^{109}(\alpha,2n)In^{111}$		-14.3 ±0.2	thresh	53b12
$Pb^{206}(d,t)Pb^{205}$	$Al^{27}(d,p)$	- 1.8 ±0.1	range	53h6
$Pb^{206}(d,p)Pb^{207}$	$Al^{27}(d,p)$	+ 4.48 ±0.05	range	53h6
$Pb^{207}(d,t)Pb^{206}$	$Al^{27}(d,p)$	- 0.42 ±0.05	range	53h6
$Pb^{207}(d,p)Pb^{208}$	$Al^{27}(d,p)$	+ 5.14 ±0.05	range	53h6
$Pb^{208}(d,t)Pb^{207}$	$Al^{27}(d,p)$	- 1.10 ±0.05	range	53h6
$Pb^{208}(d,p)Pb^{209}$	$Al^{27}(d,p)$	+ 1.65 ±0.05	range	53h6
$Bi^{209}(d,t)Bi^{208}$	$Al^{27}(d,p)$	+ 1.17 ± 0.05 g.s.value?	range	53h6
$Bi^{209}(d,p)Bi^{210}$	$Al^{27}(d,p)$	+1.94 ± 0.05 g.s.value?	range	53h6
$Bi^{209}(d,p)Bi^{210}$		+1.94 ± 0.05 g.s.value?	range	53w8

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PACKING FRACTION DIFFERENCES

Where no superscripts have been used with H, C, and O, the weights of the most abundant isotopes, namely 1, 12, and 16, respectively, are to be understood.

Δf, in Units 10^{-4} amu

Doublet	Δf	Ref.
$H_2 - D$	$+7.746 \pm 0.004$	53o1
$He^4 - D_2$	-64.01 ± 0.02	53o1
$B^{10} - Ne^{20}$	$+16.722 \pm 0.008$	53o1
$B^{10}H - B^{11}$	$+10.41 \pm 0.01$	53o1
$B^{10}D - C^{12}$	$+22.51 \pm 0.02$	53o1
$B^{10}F^{19} - C^{13}O^{16}$	$+4.500 \pm 0.005$	53o1
$B^{10}HF^{19} - B^{11}F^{19}$	$+3.817 \pm 0.005$	53o1
$B^{11} - Ne^{22}$	$+12.382 \pm 0.007$	53o1
$B^{11}H - C^{12}$	$+14.262 \pm 0.005$	53o1
$B^{11}F^{19} - Si^{30}$	$+11.316 \pm 0.007$	53o1
$C^{12} - D_3$	$+70.50 \pm 0.02$	53o1
$C_2^{12}H_4 - C^{12}O^{16}$	$+12.996 \pm 0.002$	53s3
$C_2^{12}H_4 - C^{12}O^{16}$	$+13.008 \pm 0.003$	53o1
$C^{12}H_4 - O^{16}$	$+22.759 \pm 0.005$	53o1
$C^{12}C^{13}H - C_2^{12}H_3$	-1.661 ± 0.004	53o1
$C^{13} - C^{12}H$	-3.458 ± 0.008	53e5
$C^{13}O^{16} - Si^{29}$	$+7.517 \pm 0.006$	53o1
$C^{13}O^{16} - B^{10}F^{19}$	-4.500 ± 0.005	53o1
$N^{14} - C^{12}H_2$	-8.989 ± 0.004	53o1
$N_2^{14} - C_2^{12}H_4$	-8.986 ± 0.004	53o1
$N_2^{14} - C_2^{12}H_4$	-8.982 ± 0.002	53s3
$N_2^{14} - C^{12}O^{16}$	$+4.019 \pm 0.003$	53o1
$N_2^{14} - C^{12}O^{16}$	$+4.0132 \pm 0.0008$	53s3
$N^{14}O^{16} - C_2^{12}H_6$	-16.321 ± 0.002	53s3
$N^{15} - C^{12}H_3$	-15.585 ± 0.004	53o1
$H_2O^{18} - D_2O^{16}$	-4.15 ± 0.01	53o1
$B^{10}F^{19} - C^{13}O^{16}$	$+4.500 \pm 0.005$	53o1
$B^{11}F^{19} - Si^{30}$	$+11.316 \pm 0.007$	53o1
$Ne^{20} - B^{10}$	-16.722 ± 0.008	53o1
$Ne^{20} - D_2O^{16}$	-15.355 ± 0.006	53o1
$Ne^{22} - B^{11}$	-12.382 ± 0.007	53o1
$Al^{27} - C_2^{12}H_3$	-15.561 ± 0.007	53o1
$Si^{28} - C^{12}O^{16}$	-6.435 ± 0.005	53o1

Packing Fraction Differences, Δf, in Units 10^{-4} amu (continued)

Doublet	Δf	Ref.
$Si^{29} - C^{13}O^{16}$	-7.517 ± 0.006	53o1
$Si^{30} - B^{11}F^{19}$	-11.316 ± 0.007	53o1
$P^{31}H - S^{32}$	$+2.969 \pm 0.003$	53o2
$P^{31}H_2 - S^{32}H$	$+2.876 \pm 0.004$	53o2
$P^{31}H - O_2^{16}$	-2.577 ± 0.004	53o2
$S^{32} - P^{31}H$	-2.969 ± 0.003	53o2
$S^{32}H - P^{31}H_2$	-2.876 ± 0.004	53o2
$S^{32} - O_2^{16}$	-5.539 ± 0.003	53o1
$S^{32}H_2 - S^{34}$	$+5.837 \pm 0.006$	53o1
$S^{32}O^{16} - C_4^{12}$	-6.900 ± 0.005	53o1
$S^{33}H_2 - S^{34}H$	$+3.250 \pm 0.009$	53o1
$S^{34}H_2 - C_3^{12}$	-4.596 ± 0.006	53o1
$HCl^{35} - C_3^{12}$	-6.479 ± 0.003	53o1
$Cl^{37} - C_3^{12}H$	-11.352 ± 0.004	53o1
$HCl^{37} - C_3^{12}H_2$	-11.053 ± 0.004	53o1
$A^{40} - D_2O^{16}$	-20.959 ± 0.007	53o1
$A^{40} - C_3^{12}H_4$	-17.234 ± 0.007	53o1
$A^{40} - C_2O$	-8.186 ± 0.005	52j1
$K^{40} - C_2O$	-7.78 ± 0.02	52j1
$Ca^{40} - C_2O$	-8.139 ± 0.002	52j1
$Ni^{61} - Te^{122}$	-3.43 ± 0.05	52h4
$Ni^{62} - Te^{124}$	-3.71 ± 0.03	52h4
$Ni^{64} - Te^{128}$	-3.81 ± 0.05	52h4
$Cu^{65} - Te^{130}$	-3.95 ± 0.03	52h4
$Zr^{92} - W^{184}$	-7.59 ± 0.02	53g1
$Zr^{94} - Os^{188}$	-7.59 ± 0.01	53g1
$Zr^{96} - Os^{192}$	-7.48 ± 0.02	53g1
$Mo^{92} - W^{184}$	-7.44 ± 0.02	53g1
$Mo^{94} - Os^{188}$	-7.72 ± 0.02	53g1
$Mo^{96} - Os^{192}$	-7.86 ± 0.01	53g1
$Ru^{96} - Os^{192}$	-7.55 ± 0.02	53g1
$Ru^{102} - Pb^{204}$	-8.02 ± 0.03	52h7
$Ru^{104} - Pb^{208}$	-7.96 ± 0.01	52h7

Packing Fraction Differences, Δf, in Units 10^{-4} amu
(continued)

Doublet	Δf	Ref.
$Rh^{103} - Pb^{206}$	−7.94 ±0.01	52h7
$Pd^{102} - Pb^{204}$	−7.94 ±0.04	52h7
$Pd^{102} - C_4H_3$	−13.933 ± 0.008	52h3
$Pd^{104} - Pb^{208}$	−8.05 ±0.01	52h7
$Pd^{104} - C_4H_4$	−15.32 ±0.01	52h3
$Pd^{105} - C_8H_9$	−15.78 ±0.01	52h3
$Pd^{106} - C_4H_5$	−16.57 ±0.02	52h3
$Pd^{106} - C_8H_{10}$	−16.52 ±0.02	52h3
$Pd^{108} - C_4H_6$	−17.64 ±0.01	52h3
$Pd^{110} - C_4H_7$	−18.65 ±0.01	52h3
$Cd^{106} - C_4H_5$	−16.26 ±0.01	52h3
$Cd^{108} - C_4H_6$	−17.58 ±0.01	52h3
$Cd^{110} - C_4H_7$	−18.74 ±0.01	52h3
$Cd^{111} - C_8H_{15}$	−19.203 ± 0.007	52h3
$Cd^{112} - C_4H_8$	−19.818 ± 0.009	52h3
$Cd^{112} - C_8H_{16}$	−19.860 ± 0.008	52h3
$Cd^{113} - C_8H_{17}$	−20.231 ± 0.008	52h3
$Cd^{114} - C_4H_9$	−20.82 ±0.01	52h3
$Cd^{114} - C_3H_5O$	−14.44 ±0.01	52h3
$Cd^{116} - C_3H_6O$	−15.41 ±0.01	52h3
$In^{113} - C_8H_{17}$	−20.245 ± 0.009	52h3
$In^{115} - C_9H_7$	−13.148 ± 0.009	52h3
$Sn^{115} - C_9H_7$	−13.17 ±0.02	52h3
$Sn^{116} - C_3H_6O$	−15.65 ±0.02	52h3
$Sn^{116} - C_9H_8$	−13.83 ±0.01	52h3
$Sn^{117} - C_9H_9$	−14.299 ± 0.008	52h3
$Sn^{118} - C_3H_7O$	−16.72 ±0.02	52h3
$Sn^{118} - C_9H_{10}$	−14.94 ±0.02	52h3
$Sn^{119} - C_9H_{11}$	−15.376 ± 0.009	52h3
$Sn^{120} - C_5$	− 8.15 ±0.01	52h3
$Sn^{122} - C_5H$	− 9.20 ±0.01	52h3
$Sn^{124} - C_5H_2$	−10.169 ± 0.008	52h3
$Te^{120} - C_9H_{12}$	−15.79 ±0.01	52h3
$Te^{122} - C_5H$	− 9.244 ± 0.007	52h3
$Te^{122} - Ni^{61}$	+ 3.43 ±0.05	52h4
$Te^{123} - C_5H$	+ 9.06 ±0.03	52h3

Packing Fraction Differences, Δf, in Units 10^{-4} amu
(continued)

Doublet	Δf	Ref.
$Te^{124} - C_5H_2$	−10.340 ± 0.008	52h3
$Te^{124} - Ni^{62}$	+ 3.71 ±0.03	52h4
$Te^{125} - C_5H_2$	+10.16 ±0.03	52h3
$Te^{126} - C_5H_3$	−11.359 ± 0.005	52h3
$Te^{128} - C_{10}H_8$	−12.273 ± 0.009	52h3
$Te^{128} - Ni^{64}$	+ 3.81 ±0.05	52h4
$Te^{130} - Cu^{65}$	+ 3.95 ±0.03	52h4
$Te^{130} - C_5H_5$	−13.180 ± 0.006	52h3
$I^{127} - C_{10}H_7$	−11.82 ±0.01	52h3
$Xe^{124} - C_5H_2$	−10.098 ± 0.005	52h3
$Xe^{126} - C_5H_3$	−11.31 ±0.01	52h3
$Xe^{128} - C_{10}H_8$	−12.432 ± 0.006	52h3
$Xe^{129} - C_3H_7$	−20.12 ±0.01	52h3
$Xe^{130} - C_5H_5$	−13.451 ± 0.006	52h3
$Xe^{131} - CO_2$	− 4.94 ±0.03	52h3
$Xe^{132} - C_5H_6$	−14.394 ± 0.009	52h3
$Xe^{132} - CO_2$	− 4.95 ±0.01	52h3
$Xe^{134} - C_5H_7$	−15.257 ± 0.007	52h3
$Xe^{136} - C_5H_8$	−16.051 ± 0.006	52h3
$W^{184} - Zr^{92}$	+7.59 ±0.02	53g1
$W^{184} - Mo^{92}$	+7.44 ±0.02	53g1
$Os^{188} - Zr^{94}$	+7.59 ±0.01	53g1
$Os^{188} - Mo^{94}$	+7.72 ±0.02	53g1
$Os^{192} - Zr^{96}$	+7.48 ±0.02	53g1
$Os^{192} - Mo^{96}$	+7.86 ±0.01	53g1
$Os^{192} - Ru^{96}$	+7.55 ±0.02	53g1
$Pb^{204} - Ru^{102}$	+8.02 ±0.03	52h7
$Pb^{204} - Pd^{102}$	+7.94 ±0.04	52h7
$Pb^{206} - Rh^{103}$	+7.94 ±0.01	52h7
$Pb^{208} - Ru^{104}$	+7.96 ±0.01	52h7
$Pb^{208} - Pd^{104}$	+8.05 ±0.01	52h7

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